## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	15/02/2012
Address	1 Charlotte Street, London, W1T 4QH		

Check	Evidence			Produced by	OK?
Criterion 1: predicted carbon dioxi	de emission fro	m proposed dwelling	g does not exceed the target		
TER (kg CO₂/m².a)	Fuel = Mains g Fuel factor = 1 TER = 14.94			Authorised SAP Assessor	
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 14.91			Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 14.91 < TE	ER 14.94		Authorised SAP Assessor	Passe
Criterion 2: the performance of the	e building fabrio	and the heating, ho	t water and fixed lighting system	ns should be no worse than the design	n limits
Fabric U-values					
Are all U-values better than the design limits in Table 2?	Element Wall Party wall Floor Roof Openings	Weighted average 0.30 (max 0.30) 0.00 (max 0.20) (no floor) (no roof) 1.60 (max 2.00)	Highest 0.30 (max 0.70) N/A 2.00 (max 3.30)	Authorised SAP Assessor	Passe
Thermal bridging					
How has the loss from thermal bridges been calculated?	Thermal bridgi	ng calculated using o	default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems					
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Mains gas, Reg Potterton Pror Efficiency = 89 Minimum = 88	gular boiler from data nax 24/2 HE Plus .60% - SEDBUK 2009		Authorised SAP Assessor	Passe
Does the insulation of the hot	· · · · · · · · · · · · · · · · · · ·	ne = 135.00 litres		Authorised SAP Assessor	Passe
water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Nominal cylind Maximum peri		= 1.77kWh/day	,	
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance		perature zone contro	ol	Authorised SAP Assessor	Passe
Guide?	Hot water cont Boiler interlock Cylinder therm	k (main system 1)			
	Separate wate	r control			

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comp with paragraphs 42 to 44?	oly Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has app	ropriate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of t	he dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettere in practice?	The following walls/wall have a U-value less than 0.2W/m²K: d) • Part Wall (0.00)	Authorised SAP Assessor	

### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	15/02/2012
Address	1 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimens	sions						
· ·		Area (m²)		Average stor height (m)	•	Volume (m³)	)
owest occupied		74.20	(1a) x	2.70	(2a) =	200.34	(3a
Total floor area	(1a) + (1b) + (1c) + (1d)(1n)	= 74.20	(4)				
Owelling volume				(3a) + (3b) +	(3c) + (3d)(3n) =	200.34	(5)
2. Ventilation rate							
						m³ per hour	r
Number of chimneys				0	x 40 =	0	(6
lumber of open flues				0	x 20 =	0	(6
lumber of intermittent fans	S			0	x 10 =	0	(7
Number of passive vents				0	x 10 =	0	(7
Number of flueless gas fires				0	x 40 =	0	(7
						Air changes po hour	er
nfiltration due to chimneys	, flues, fans, PSVs	(6a) + (6b) + (	7a) + (7b) + (7c	) = 0	÷ (5) =	0.00	(8)
f a pressurisation test has b	peen carried out or is intended, procee	ed to (17), otherw	ise continue fro	m (9) to (16)			
air permeability value, q50,	expressed in cubic metres per hour p	per square metre	of envelope are	ea		5.00	(1
f based on air permeability	value, then (18) = $[(17) \div 20] + (8)$ , ot	herwise (18) = (1	5)			0.25	(1
Air permeability value appli	es if a pressurisation test has been do	ne, or a design or	specified air pe	ermeability is beir	ng used		
lumber of sides on which d	welling is sheltered					3	(1
helter factor					1 - [0.075 x (19)] =	0.78	(2
Adjusted infiltration rate					(18) x (20) =	0.19	(2
nfiltration rate modified for	r monthly wind speed:						
Jan	Feb Mar Apr	May Jun	Jul	Aug Sep	Oct N	lov Dec	

Adjusted infiltration	on rate									(18) x (2	20) =	0.19	(21)
Infiltration rate mo	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind speed	from Table	2 7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m ·	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltration	n rate (allo	owing for sh	nelter and v	vind speed	) = (21) × (2	2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	]

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

2.62

0.50

0.50 (23b)

(22b)

(23a)

∑(22b)1...12 =

If balanced wit												77.35	(23c)
a) If balanced r								1	T	T	T	T	٦
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air chang						1							¬
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses an	d heat loss	parameter											
The κ-value is the	heat capaci	ty per unit	area, see To	able 1e.									
El	ement		Gross Area, m²		nings, n²	Net area A, m²		alue, 'm²K	A x U, W/K		alue, m².K	Αxκ, kJ/K	_
Window*						8.20	x 1	.42 =	11.60	N	/A	N/A	(27)
Doors						2.10	x 2	.00 =	4.20	N	/A	N/A	(26)
External wall						35.87	x 0	.30 =	10.76	N	/A	N/A	(29a)
Party Wall						57.24	x 0	.00 =	0.00	N	/A	N/A	(32)
Total area of exter	rnal elemen	ts ∑A, m²				46.17	(31)						
* for windows and	l roof windo	ws, effecti	ve window l	J-value is	calculated	using formu	la 1/[(1/U	Value)+0.04	4] paragrap	oh 3.2			
Fabric heat loss, V	$V/K = \sum (A \times I)$	J)							(2	6)(30) + (	32) =	26.56	(33)
Heat capacity Cm	= Σ(A x κ)							(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass par	ameter (TM	P) in kJ/m²	K						Calcula	ted separat	ely =	250.00	(35)
Thermal bridges: 2	Σ(L x Ψ) calc	ulated usir	ng Appendix	K								6.93	(36)
if details of the	ermal bridgir	ng are not	known then	(36) = 0.1	5 x (31)								
Total fabric heat lo	oss									(33) + (	36) =	33.49	(37)
Ventilation heat lo	ss calculate	d monthly	0.33 x (25	)m x (5)									_
(38)m	24.78	23.82	23.82	21.90	20.62	19.98	19.34	19.34	20.94	21.90	22.86	23.82	(38)
Heat transfer coef			1								T		¬
(39)m	58.27	57.31	57.31	55.39	54.11	53.47	52.83	52.83	54.43	55.39	56.35	57.31	_ 
	/a\	/ 3., (00)	(4)						Average =	∑(39)112	/12 = [	55.41	(39)
Heat loss paramet (40)m	0.79	/m²K (39) 0.77	m ÷ (4) 0.77	0.75	0.73	0.72	0.71	0.71	0.73	0.75	0.76	0.77	٦
(40)111	0.75	0.77	0.77	0.75	0.75	0.72	0.71		Average =			0.75	 (40)
4. Water heating	energy req	uirement											
											k	Wh/year	
Assumed occupan	cy, N									2.34	(42	)	
If TFA > 13.9, N	l = 1 + 1.76 >	k [1 - exp(-0	0.000349 x	(TFA - 13.9	$)^2)] + 0.001$	l3 x (TFA - 1	3.9)						
If TFA ≤ 13.9, N	l = 1												
Annual average ho	ot water usa	ge in litres	per day Vd	,average =	(25 x N) +	36				89.86	6 (43	)	
Annual average h	ot water usa	ige has bee	en reduced l	by 5% if the	e dwelling	is designed	to achieve	a water us	e target of	not more ti	han 125 lit	res	
per person per day	y (all water i	use, hot an	d cold)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in						1	90.99	04.47	99.06	01.66	05.25	00.05	٦
(44)m	98.85	95.25	91.66	88.06	84.47	80.88	80.88	84.47	88.06	91.66	95.25	98.85	
Frank santant of	h atatau		lated we suct	hl. 4 100	) ) (al .a	/2 <i>C</i>	00 134/5/		Tables 1b	∑(44)1	.12 =	1078.33	(44)
Energy content of (45)m	146.94	128.51	132.61	$\frac{115.62}{115.62}$	110.94	95.73	00 kwn/ 88.71	101.79	103.01	120.05	131.04	142.30	٦
(45)111	140.94	120.51	132.01	113.02	110.94	93.73	88.71	101.73	103.01	Σ(45)1		1417.25	 ☐ (45)
If instantaneous w	vater heatin	a at noint i	of use (no hi	ot water st	torage) en	ter () in hove	es (46) to (	61)		۲(۳۶)۲۰۰	.12 -	± T ± 1 . £ J	(+2)
For community he								/					
Distribution loss (	_			-									
(46)m	22.04	19.28	19.89	17.34	16.64	14.36	13.31	15.27	15.45	18.01	19.66	21.35	(46)
												te Street v	

84.45 86.67 (65)m 93.39 82.95 88.63 81.54 81.42 74.93 74.03 77.35 91.85 (65)

5. Internal gain	s (see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5), Wa	atts											
(66)m	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	(66
Lighting gains (d	alculated in A	Appendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	52.12	46.29	37.65	28.50	21.30	17.99	19.43	25.26	33.91	43.05	50.25	53.57	(67)
Appliances gain	s (calculated i	in Appendix	ι L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	308.80	312.00	303.93	286.74	265.04	244.64	231.02	227.81	235.89	253.08	274.78	295.17	(68)
Cooking gains (d	alculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	(69)
Pumps and fans	gains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evap	oration (nega	ative values	) (Table 5)										
(71)m	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	-93.75	(71)
Water heating g	ains (Table 5	)											
(72)m	125.53	123.44	119.12	113.25	109.44	104.07	99.50	105.35	107.43	113.51	120.37	123.45	(72)

Solar gains are calculated	,	•			•							
Rows (74) to (82) are used	l 12 times, one	e for each n	nonth, repe	ating as ne	eded if there	is more	than one win	dow type	e.			
Details for month of Janua	ary and annua	l totals are	shown belo	w:								
	Access fact	or	Area m²	So	olar flux W/n	n² g	g Specific data	a I	FF Specific da		Gains (W	)
	Table 6d	_					or Table 6b		or Table 6c			_
Southwest	0.77	х	6.60	x	37.39	x 0.9 x	0.63	Х	0.70	=	75.41	(79)
Northeast	0.77	x	1.60	x	11.51	x 0.9 x	0.63	x	0.70	=	5.63	(75)
Solar gains in watts, calcu	lated for each	month ∑(7	4)m(82)m	1								
(83)m 81.0	4 140.07	189.98	241.89	272.50	279.73	272.97	249.35	212.44	160.43	97.52	69.02	(83)
Total gains - internal and	solar (73)m + (	(83)m										
(84)m 675.7	730.09	758.95	778.66	776.55	754.70	731.20	716.06	697.94	678.35	651.19	649.49	(84)
	•	•		•								_
7. Mean internal temper	rature (heatin	g season)										
Temperature during heati	ng periods in	the living a	rea from Tal	ble 9, Th1(	°C)						21.00	(85)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains	for living area	a, η1,m (see	e Table 9a)									
(86)m 0.97	0.95	0.90	0.81	0.64	0.45	0.30	0.30	0.52	0.78	0.94	0.97	(86)
Mean internal temp of liv	ing area T1 (st	eps 3 to 7 i	n Table 9c)									
(87)m 20.6	5 20.73	20.83	20.91	20.96	20.96	20.96	20.96	20.96	20.93	20.78	20.66	(87)
Temperature during heati	ng periods in	the living a	rea from Tal	ble 9, Th2(	°C)							
(88)m 20.2	7 20.28	20.28	20.30	20.32	20.32	20.33	20.33	20.31	20.30	20.29	20.28	(88)
Utilisation factor for gains	for rest of dw	/elling η2,m	ı (see Table	9a)								
(89)m 0.97	0.94	0.88	0.78	0.59	0.41	0.25	0.25	0.47	0.74	0.93	0.97	(89)
Mean internal temperatu	re in the rest o	of dwelling	T2 (follow s	teps 3 to 7	in Table 9c)							_
(90)m 19.8	1 19.94	20.07	20.19	20.25	20.27	20.28	20.28	20.26	20.21	20.02	19.84	(90)
Living area fraction		•					fLA 2	6.98	÷ (4) =		0.36	(91)
Mean internal temperatu	re for the who	le dwelling	fLA x T1 +(1	1 - fLA) x T2	2							
(92)m 20.1		20.35	20.45	20.51	20.52	20.53	20.53	20.51	20.47	20.30	20.14	(92)
Apply adjustment to the r			re from Tab	le 4e. wher			<u> </u>					٠, ١
(93)m 19.9°		20.20	20.30	20.36	20.37	20.38	20.38	20.36	20.32	20.15	19.99	(93)
		1					<u> </u>					
8. Space heating require	ment											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Set Ti to the mean interna	l temperature	obtained a	at step 11 o	f Table 9b,	so that tim =	= (93)m a	nd recalculate	e the uti	lisation facto	r for gains	using Tabl	e 9a)
Utilisation factor for gains	, ηm											
(94)m 0.96	0.94	0.88	0.78	0.60	0.41	0.25	0.26	0.47	0.75	0.93	0.96	(94)
Useful gains, ηmGm, W =	(94)m x (84)m	1										
(95)m 649.8	88 683.00	667.76	607.17	463.94	308.35	183.69	183.68	329.25	505.52	602.48	625.21	(95)
Monthly average external	temperature	from Table	8									
(96)m 4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean in	ternal temper	ature. Lm.	W									

Heat loss rate for mean internal temperature, Lm, W 901.27 864.06 767.67 642.72 468.54 308.58 183.69 740.75 183.69 329.98 527.47 864.87 Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m187.03 74.33 0.00 0.00 99.56 (98)m 121.67 25.59 0.00 16.33 178.31 3.42 Total per year (kWh/year) =  $\Sigma$ (98)1...5, 10...12 = 706.25 (98)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating requirement in kWh/m²/year

9.52

 $(98) \div (4)$ 

(99)

Space heating:			
Fraction of space heating from secondary/supplementary system (Table 11	.)	0.00 (201)	
Fraction of space heating from main system(s) 1 - (201)		1.00 (202)	
Fraction of main heating from main system 2		0.00 (203)	
Fraction of total space heat from main system 1 (202) x [1 - (203)]		1.00 (204)	
Fraction of total space heat from main system 2 (202) x (203)		0.00 (205)	
Efficiency of main space heating system 1 (%)		90.60 (206)	
(from database or Table 4a/4b, adjusted where appropriate by the amount			able 4c)
Jan Feb Mar Apr May	Jun Jul A	Aug Sep Oct	Nov Dec
Space heating requirement, kWh/month (as calculated above)	0.00 0.00 0.00	0.00 1.00 1.00	00.50 170.21
(98)m 187.03 121.67 74.33 25.59 3.42	' '	0.00 0.00 16.33	99.56 178.31
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x (211)m 206.44 134.30 82.04 28.25 3.78		0.00 0.00 18.03	109.89 196.81
(211)111 200.44 134.30 02.04 20.23 3.70		$\kappa$ Wh/year) = $\Sigma$ (211)15, 1012	
Water heating	Total per year (KV	(VVII)  year = 2(211)15, 1012	1- 779.55 (211)
Water heating:			
Output from water heater, kWh/month (calculated above) (64)m	149.60 144.37 157	57.46 156.88 175.71	184.91 197.97
(04)111 202.01 176.79 106.20 105.49 100.00	149.00   144.57   157	Σ(64)112	
Efficiency of water heater per month		2(04)112	2072.08 (04)
(217)m 84.70 83.91 82.66 81.16 80.09	79.90 79.90 79	9.90 79.90 80.71	83.34 84.64
Fuel for water heating, kWh/month = $(64)$ m x $100 \div (217)$ m	73.30   73.30   73	5.50   75.50   00.71	0.01
(219)m 239.20 213.07 227.77 208.84 208.02	187.24 180.69 197	97.07 196.35 217.71	221.86 233.90
		year (kWh/year) = $\Sigma$ (219)112	
	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	( 2)
Annual Totals Summary:		kWh/yea	r kWh/year
Space heating fuel used, main system 1		7,7	779.53 (211)
Water heating fuel used			2531.72 (219)
Electricity for pumps, fans and electric keep-hot (Table 4f):			2551.72
mechanical ventilation fans - balanced, extract or positive input from or	ıtside	122.21	(230a)
warm air heating system fans	acside	0.00	(230b)
central heating pump		130.00	(230c)
oil boiler pump		0.00	(230d)
boiler flue fan		45.00	(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00	(230f)
pump for solar water heating		0.00	(230g)
Total electricity for the above		∑(230a)(230	Og) 297.21 (231)
Electricity for lighting (calculated in Appendix L):			368.17 (232)
Electricity for lighting (edicalated in Appendix 2).			300.17
10a. Fuel costs - Individual heating systems including micro-CHP			
Fuel k	Wh/year	Fuel price (Table 12)	Fuel cost £/year
Space heating - main system 1 77	79.53 x	3.10 x 0.01 =	24.17 (240)
	31.72 x	3.10 x 0.01 =	78.48 (247)
	97.21 x	11.46 x 0.01 =	34.06 (249)
	58.17 x	11.46 x 0.01 =	42.19 (250)
Additional standing charges (Table 12)			106.00 (251)
Total energy cost		(240)(242) + (245)(25	
		(= .5,(= :=,	
11a. SAP rating - Individual heating systems including micro-CHP			
Energy cost deflator (Table 12)			0.47 (256)

Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.12	(257)
SAP value		84.33	]
SAP rating		84	(258)
SAP band		В	]

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	779.53	х	0.198	=	154.35	(261)
Water heating	2531.72	х	0.198	=	501.28	(264)
Space and water heating			(261) + (262)	+ (263) + (264) =	655.63	(265)
Pumps, fans and electric keep-hot	297.21	х	0.517	=	153.66	(267)
Lighting	368.17	х	0.517	=	190.34	(268)
Total carbon dioxide emissions				∑(261)(271) =	999.63	(272)
Dwelling carbon dioxide emissions rate				(272) ÷ (4) =	13.47	(273)
El value					88.76	
El rating (see section 14)					89	(274)
El band					В	]
13a. Primary energy - Individual heating systems in	cluding micro-CHP					
	Energy kWh/year		Primary Energy Factor	,	Primary Energy	
Space heating - main system 1	779.53	x	1.02	=	795.12	(261*

13a. Primary energy - Individual heating systems including mic	ro-CHP					
	Energy kWh/year		Primary Energ Factor	У	Primary Energy	,
Space heating - main system 1	779.53	х	1.02	=	795.12	(261*)
Water heating	2531.72	х	1.02	=	2582.35	(264*)
Space and water heating			(261*) + (262*) +	(263*) + (264*) =	3377.47	(265*)
Pumps, fans and electric keep-hot	297.21	х	2.92	=	867.85	(267*)
Lighting	368.17	х	2.92	=	1075.05	(268*)
Total primary energy kWh/year			Σ	(261*)(271*) =	5320.37	(272*)
Primary energy kWh/m2/year				(272*) ÷ (4) =	71.70	(273*)

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	1 Charlotte Street, London, W1T 4QH		

Check	Evidence		Produced by	OK?
Criterion 1: predicted carbon dioxi	de emission fro	om proposed dwelling does not exceed the target		
	Fuel = Mains g Fuel factor = 1 TER = 14.94		Authorised SAP Assessor	
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 9.67		Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 9.67 < TE	R 14.94	Authorised SAP Assessor	Passed
Criterion 2: the performance of the	e building fabri	c and the heating, hot water and fixed lighting sys	tems should be no worse than the design	limits
Fabric U-values				
Are all U-values better than the design limits in Table 2?	Element Wall Party wall Floor Roof Openings	Weighted average Highest 0.20 (max 0.30)	Authorised SAP Assessor	Passed
Thermal bridging				
How has the loss from thermal bridges been calculated?	Thermal bridg	ing calculated using default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems				
Compliance Guide?	Mains gas, Repotterton Pro Efficiency = 89 Minimum = 88	gular boiler from database max 24/2 HE Plus 9.60% - SEDBUK 2009	Authorised SAP Assessor	Passed
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Nominal cyline Maximum per	ne = 135.00 litres der loss = 1.50kWh/day mitted cylinder loss = 1.77kWh/day rater pipes are insulated	Authorised SAP Assessor	Passed
controls provision set out in the Domestic Heating Compliance Guide?	Hot water con	perature zone control trol:	Authorised SAP Assessor	Passe
	Boiler interloc Cylinder thern Separate water			

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appro	priate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of the	e dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered in practice?	The following walls/wall have a U-value less than 0.2W/m²K:  • Part Wall (0.00)  Use of the following low carbon or renewable technologies:  • Photovoltaic array	Authorised SAP Assessor	

### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	1 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimension	ns					
		Area (m²)	Average st height (		Volume (m³)	
Lowest occupied		74.20 (1a)	x 2.70	(2a) =	200.34	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	74.20 (4)				
Dwelling volume			(3a) + (3b	) + (3c) + (3d)(3n) =	200.34	(5)
2. Ventilation rate						
					m³ per hour	_
Number of chimneys			0	x 40 =	0	(6a)
Number of open flues			0	x 20 =	0	(6b)
Number of intermittent fans			0	x 10 =	0	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fires			0	x 40 =	0	(7c)
					Air changes pe hour	er
Infiltration due to chimneys, flo	ues, fans, PSVs	(6a) + (6b) + (7a) + (7b	) + (7c) = 0	÷ (5) =	0.00	(8)
If a pressurisation test has bee	n carried out or is intended, proceed to	o (17), otherwise conti	nue from (9) to (16)			
Air permeability value, q50, ex	pressed in cubic metres per hour per s	square metre of envelo	pe area		5.00	(17)
If based on air permeability va	lue, then (18) = $[(17) \div 20] + (8)$ , other	wise (18) = (16)			0.25	(18)
Air permeability value applies i	if a pressurisation test has been done,	or a design or specified	d air permeability is b	eing used		
Number of sides on which dwe	elling is sheltered				3	(19)
Shelter factor				1 - [0.075 x (19)] =	0.78	(20)
Adjusted infiltration rate				(18) x (20) =	0.19	(21)
Infiltration rate modified for m	onthly wind speed:					

Infiltration rate me	odified for	monthly wi	nd speed:										_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind speed	from Table	7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m ·	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	.12 =	13.52	(22a)

Adjusted infiltration	on rate (allo	wing for sh	elter and v	vind speed)	= (21) × (2	2a)m						
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25

 $\Sigma$ (22b)1...12 = 2.62 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

If balanced wit	th heat reco	overy: effici	ency in % a	allowing for	in-use fact	or (from Ta	able 4h) =					77.35	(23c)
a) If balanced		1	with heat	recovery (N	//VHR) (22		1	:) ÷ 100] =		_			¬
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air chang	ge rate - en	ter (24a) or	(24b) or (2	24c) or (24d	) in box (25	5)			_	_			_
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses ar	nd heat loss	s parametei											
The к-value is the	heat capac	ity per unit	area, see	Table 1e.									
El	ement		Gross Area, m <sup>2</sup>		nings, n²	Net area A, m²		alue, m²K	A x U, W/K		/alue, /m².K	Ахк, kJ/K	_
Window*						8.20	x 1	.42 =	11.60	<u> </u>	N/A	N/A	(27)
Doors						2.10	x 2	.00 =	4.20		N/A	N/A	(26)
External wall						35.87	x 0	.20 =	7.17		N/A	N/A	(29a)
Party Wall						57.24	_ x _ 0	.00 =	0.00		N/A	N/A	(32)
Total area of exte	rnal elemei	nts ∑A, m²				46.17	(31)						
* for windows and	d roof wind	ows, effecti	ve window	U-value is	calculated	using form	ula 1/[(1/U	Value)+0.0	4] paragra <sub>l</sub>	ph 3.2			_
Fabric heat loss, V	V/K = ∑(A ×	U)							(2	26)(30) +	(32) =	22.98	(33)
Heat capacity Cm	= Σ(A x κ)							(28)	(30) + (32)	+ (32a)(	32e) =	N/A	(34)
Thermal mass par	ameter (TN	/IP) in kJ/m²	K						Calcula	ted separa	ately =	250.00	(35)
Thermal bridges:	∑(L x Ψ) cal	culated usir	ng Append	ix K								6.93	(36)
if details of the	ermal bridg	ing are not	known the	n (36) = 0.1	5 x (31)								_
Total fabric heat I	oss									(33) +	(36) =	29.90	(37)
Ventilation heat le	oss calculat	ed monthly	0.33 x (2	5)m x (5)									_
(38)m	24.78	23.82	23.82	21.90	20.62	19.98	19.34	19.34	20.94	21.90	22.86	23.82	(38)
Heat transfer coe		T		1					T	T	T	T	¬
(39)m	54.68	53.72	53.72	51.80	50.52	49.88	49.24	49.24	50.84	51.80	52.76	53.72	_ □
Heat loss parame	ter (HLP), V	V/m²K (39)	m ÷ (4)						Average =	∑(39)11	2/12 = [	51.83	(39)
(40)m	0.74	0.72	0.72	0.70	0.68	0.67	0.66	0.66	0.69	0.70	0.71	0.72	
									Average =	∑(40)11	2/12 =	0.70	(40)
4. Water heating	g energy re	quirement											
												kWh/year	
Assumed occupar	ncy, N									2.3	4 (4	2)	
If TFA > 13.9, N	N = 1 + 1.76	x [1 - exp(-	0.000349 >	(TFA - 13.9	) <sup>2</sup> )] + 0.003	13 x (TFA - :	13.9)						
If TFA ≤ 13.9, N	N = 1												
Annual average h	ot water us	age in litres	per day V	d,average =	(25 x N) +	36				89.8	36 (4	3)	
Annual average h	ot water us	age has bee	en reducea	by 5% if th	e dwelling	is designed	to achieve	a water us	e target of	not more	than 125 li	tres	
per person per da	y (all water	use, hot an	d cold)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage i		-				le 1c x (43)				_			_
(44)m	98.85	95.25	91.66	88.06	84.47	80.88	80.88	84.47	88.06	91.66	95.25	98.85	
										∑(44)1	12 =	1078.33	(44)
Energy content of						_					1	1	¬
(45)m	146.94	128.51	132.61	115.62	110.94	95.73	88.71	101.79	103.01	120.05	131.04	-	_ ¬ , ,
<i>(C)</i>					. ,		1.01	Cal		∑(45)1	12 =	1417.25	(45)
If instantaneous v For community he		-						61)					
Distribution loss	_					•							
(46)m	22.04	19.28	19.89	17.34	16.64	14.36	13.31	15.27	15.45	18.01	19.66	21.35	(46)
													_
												e StreetPV v	

	•	5 and 5a)					_		_	_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5), Wa	atts											
(66)m	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	140.62	(66
Lighting gains (c	alculated in A	ppendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	52.12	46.29	37.65	28.50	21.30	17.99	19.43	25.26	33.91	43.05	50.25	53.57	(67
Appliances gains	(calculated i	n Appendix	L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	308.80	312.00	303.93	286.74	265.04	244.64	231.02	227.81	235.89	253.08	274.78	295.17	(68
Cooking gains (c	alculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	51.41	(69
		_ ,											
Pumps and fans	gains (Table	5a)											
Pumps and fans (70)m	gains (Table 10.00	5a) 10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70
•	10.00	10.00	I.	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70
(70)m	10.00	10.00	I.	10.00	10.00	10.00	10.00 -93.75	10.00 -93.75	-93.75	10.00 -93.75	10.00 -93.75	10.00	(70 (71
(70)m Losses e.g. evap	10.00 oration (nega -93.75	10.00 htive values -93.75	) (Table 5)									i	, r

		Table 6d				,	0	or Table 6b	)	or Table 6c			
Southwest		0.77	x	6.60	x	37.39	x 0.9 x	0.63	x	0.70	=	75.41	(79)
Northeast		0.77	x	1.60	х	11.51	x 0.9 x	0.63	x	0.70	=	5.63	(75)
Solar gains in watt	s, calculate	d for each	month ∑(7	4)m(82)m									
(83)m	81.04	140.07	189.98	241.89	272.50	279.73	272.97	249.35	212.44	160.43	97.52	69.02	(83)
Total gains - interr	nal and sola	ır (73)m + (	83)m										
(84)m	675.76	730.09	758.95	778.66	776.55	754.70	731.20	716.06	697.94	678.35	651.19	649.49	(84)
			,										
7. Mean internal													
Temperature duri	ng heating	periods in t	he living ar	ea from Tal	ole 9, Th1(°	C)					L	21.00	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor f	or gains for	· living area	, η1,m (see	Table 9a)									7
(86)m	0.97	0.94	0.88	0.78	0.60	0.42	0.28	0.28	0.49	0.75	0.93	0.97	(86)
Mean internal ten	np of living	area T1 (ste	eps 3 to 7 ii	n Table 9c)									_
(87)m	20.71	20.78	20.87	20.93	20.96	20.97	20.97	20.97	20.96	20.94	20.83	20.72	(87)
Temperature duri	ng heating	periods in t	he living ar	ea from Tal	ole 9, Th2(°	C)							_
(88)m	20.31	20.32	20.32	20.34	20.36	20.37	20.37	20.37	20.35	20.34	20.33	20.32	(88)
Utilisation factor f	or gains for	rest of dw	elling η2,m	(see Table	9a)								
(89)m	0.96	0.93	0.86	0.75	0.56	0.38	0.23	0.24	0.44	0.71	0.91	0.96	(89)
Mean internal ten	nperature ii	n the rest o	f dwelling 1	Γ2 (follow st	teps 3 to 7	in Table 9c	)						
(90)m	19.93	20.05	20.16	20.26	20.30	20.32	20.32	20.32	20.30	20.27	20.11	19.96	(90)
Living area fraction	n							fLA	26.98	÷ (4) =	:	0.36	(91)
Mean internal ten	nperature f	or the whol	e dwelling	fLA x T1 +(1	L - fLA) x T2								
(92)m	20.21	20.31	20.42	20.50	20.54	20.55	20.56	20.56	20.54	20.52	20.37	20.23	(92)
Apply adjustment	to the mea	n internal t	emperatur	e from Tabl	e 4e, wher	e appropria	ate						
(93)m	20.06	20.16	20.27	20.35	20.39	20.40	20.41	20.41	20.39	20.37	20.22	20.08	(93)
8. Space heating	requireme	nt											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Set Ti to the mean	internal te	mperature	obtained a	t step 11 of	f Table 9b,	so that tim	= (93)m ar	nd recalcula	te the utili	sation facto	r for gains	using Table	9a)
Utilisation factor f	or gains, ηr	n											,
(94)m	0.95	0.92	0.86	0.75	0.56	0.38	0.24	0.24	0.44	0.71	0.91	0.96	(94)
Useful gains, ηmG	m, W = (94	)m x (84)m											

Useful gains,  $\eta$ mGm, W = (94)m x (84)m 592.97 (95)m 645.28 674.06 651.69 581.78 436.92 289.29 172.69 172.69 309.47 482.51 620.70 (95)Monthly average external temperature from Table 8 4.50 4.90 (96)m 5.00 6.80 8.70 11.70 14.60 16.90 16.90 14.30 10.80 7.00 (96)Heat loss rate for mean internal temperature, Lm, W 850.94 814.66 723.37 603.65 439.17 289.38 172.69 172.69 309.78 495.53 697.70 815.72 Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m 153.01 94.48 0.00 0.00 9.69 75.40 145.10 (98)m 53.33 15.75 1.68 0.00 Total per year (kWh/year) =  $\Sigma$ (98)1...5, 10...12 = 548.44 (98)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating requirement in kWh/m²/year

7.39

(99)

 $(98) \div (4)$ 

Space heating:	<u>,</u>			ſ			7 (55.)			
Fraction of space heating from secondary/supplementary system (	(Table 11	.)		[		0.00	(201)			
Fraction of space heating from main system(s) 1 - (201)				]		1.00	(202)			
Fraction of main heating from main system 2						0.00	<b>」(203)</b>			
Fraction of total space heat from main system 1 (202) x [1 - (203)]						1.00	(204)			
Fraction of total space heat from main system 2 (202) x (203)						0.00	(205)			
Efficiency of main space heating system 1 (%)						90.60	(206)			
(from database or Table 4a/4b, adjusted where appropriate by the						djustmen	-			
·	Vlay	Jun	Jul	Αι	ıg	Sep	Oct	Nov	Dec	
Space heating requirement, kWh/month (as calculated above) (98)m 153.01 94.48 53.33 15.75 1	1.68	0.00	0.00	0.0	20	0.00	9.69	75.40	145.10	7
	-			0.0	JU	0.00	9.09	/5.40	145.10	
Space heating fuel (main heating system 1), kWh/month = $(98)$ m x $(211)$ m $168.89$ $104.29$ $58.86$ $17.38$ $3$	1.85	0.00 0.00	0.00	0.0	00	0.00	10.69	83.23	160.15	1
(211)111 100.05 104.25 30.00 17.30	1.63						1)15, 10		605.34	] (211)
Water hosting.			otai pei ye	ear (KV	vii/ye	ai) – <u>2</u> (21	1)15, 10	12 -	005.54	(211)
Water heating:										
Output from water heater, kWh/month (calculated above) (64)m 202.61 178.79 188.28 169.49 16	66.60	149.60	144.37	157	16	156.88	175.71	184.91	197.97	1
(64)m 202.61   178.79   188.28   169.49   16	00.00	149.00	144.57	157	.40	130.00	Σ(64)1		2072.68	] (64)
Titi-i-a-a							2(64)1	.12 -	2072.06	(64)
Efficiency of water heater per month (217)m 84.18 83.30 82.04 80.71 7	9.99	79.90	79.90	79.	an I	79.90	80.40	82.73	84.10	1
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m	9.99	79.90	79.90	/ / / /	90	79.90	80.40	02.73	84.10	J
	08.27	187.24	180.69	197	07	196.35	218.56	223.51	235.39	7
(213)111	30.27	107.24					= Σ(219)1		2541.91	(219)
			Tota	i pei y	cai (K	vvii, year,	- 2(219)1	12 -	2541.91	[(219)
Annual Totals Summary:							kWh/ye	ear	kWh/year	
										٦
Space heating fuel used, main system 1									605.34	(211)
Space heating fuel used, main system 1 Water heating fuel used									605.34 2541.91	] (211) ] (219)
										7
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):	t from ou	utside					122.2	1		7
Water heating fuel used	t from ou	utside					0.00	1		(219)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input	t from ou	utside								(219) (230a)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inpu warm air heating system fans	t from ou	utside					0.00			(230a) (230b)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump	t from ou	utside					0.00	0		(230a) (230b) (230c)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inpu warm air heating system fans central heating pump oil boiler pump	t from ou	utside					0.00 130.00 0.00	0		(230a) (230b) (230c) (230d) (230e) (230e) (230f)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating	t from ou	utside					0.00 130.00 0.00 45.00 0.00	0	2541.91	(230a) (230b) (230c) (230d) (230e) (230f) (230g)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inpu warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler	t from ou	utside					0.00 130.00 0.00 45.00 0.00	0		(230a) (230b) (230c) (230d) (230e) (230f)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above	t from ou	utside					0.00 130.00 0.00 45.00 0.00	0	2541.91	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):		utside					0.00 130.00 0.00 45.00 0.00	0	2541.91	(230a) (230b) (230c) (230d) (230e) (230f) (230g)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Q)		utside					0.00 130.00 0.00 45.00 0.00	0	2541.91 297.21 368.17	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q)  Electricity generated by PVs (Appendix M) (negative quantity)		utside					0.00 130.00 0.00 45.00 0.00	0	2541.91	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Q)							0.00 130.00 0.00 45.00 0.00	30g)	2541.91 297.21 368.17 -657.28	(230a) (230b) (230c) (230c) (230d) (230e) (230f) (230g) (231) (232)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q)  Electricity generated by PVs (Appendix M) (negative quantity)		utside Wh/year				el price	0.00 130.00 0.00 45.00 0.00	30g)	2541.91 297.21 368.17	(230a) (230b) (230c) (230c) (230d) (230e) (230f) (230g) (231) (232)
Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Q) Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-CHP	: Fuel k\	Wh/year	x		(Ta	el price ible 12)	0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(2	30g)	297.21 368.17 -657.28	(230a) (230b) (230c) (230c) (230d) (230e) (230f) (230g) (231) (232)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q)  Electricity generated by PVs (Appendix M) (negative quantity)	Fuel k\		x x		(Ta	el price	0.00 130.00 0.00 45.00 0.00	30g)	2541.91 297.21 368.17 -657.28	(230a) (230b) (230c) (230c) (230d) (230e) (230f) (230g) (231) (232)

	Fuel kWh/year		Fuel price (Table 12)		Fuel cost £/year		
Space heating - main system 1	605.34	x	3.10	x 0.01 =	18.77	(240)	
Water heating cost (other fuel)	2541.91	x	3.10	x 0.01 =	78.80	(247)	
Pumps, fans and electric keep-hot	297.21	x	11.46	x 0.01 =	34.06	(249)	
Energy for lighting	368.17	x	11.46	x 0.01 =	42.19	(250)	
Additional standing charges (Table 12)					106.00	(251)	
Energy saving/generation technologies (Appendices M, N ar	nd Q):						

PV savings (negative quantity)	-657.28	x	11.46 x 0.01 =	-75.32	(252)
Total energy cost			(240)(242) + (245)(254		(255)
11a. SAP rating - Individual heating systems including micro-CHF	<b>,</b>				
Energy cost deflator (Table 12)				0.47	(256)
Energy cost factor (ECF)			[(255) x (256)] ÷ [(4) + 45.0] =	0.81	(257)
SAP value				88.75	<u></u>
SAP rating				89	(258)
SAP band				В	j
12a. Carbon dioxide emissions - Individual heating systems inclu	ıding micro-CHP				
	Energy kWh/year		Emissions Factor	Emissions (kgCO2/year)	
Space heating - main system 1	605.34	Х	0.198 =	119.86	(261)
Water heating	2541.91	х	0.198 =	503.30	(264)
Space and water heating			(261) + (262) + (263) + (264) =	623.15	(265)
Pumps, fans and electric keep-hot	297.21	x	0.517 =	153.66	(267)
Lighting	368.17	x	0.517 =	190.34	(268)
Energy saving/generation technologies:					
PV emission savings (negative quantity)	-657.28	х	0.529 =	-347.70	(269)
Total carbon dioxide emissions			∑(261)(271) =	619.45	(272)
Dwelling carbon dioxide emissions rate			(272) ÷ (4) =	8.35	(273)
El value				93.04	
El rating (see section 14)				93	(274)
EI band				А	
13a. Primary energy - Individual heating systems including micro	o-CHP				
	Energy kWh/year		Primary Energy Factor	Primary Energy	1
Space heating - main system 1	605.34	x	1.02 =	617.45	(261*)
Water heating	2541.91	x	1.02 =	2592.74	(264*)
Space and water heating			(261*) + (262*) + (263*) + (264*) =	3210.19	(265*)
Pumps, fans and electric keep-hot	297.21	х	2.92 =	867.85	(267*)
Lighting	368.17	х	2.92 =	1075.05	(268*)
Energy saving/generation technologies:					
PV primary energy savings (negative quantity)	-657.28	х	2.92 =	-1919.26	(269*)
Total primary energy kWh/year			∑(261*)(271*) =	3233.83	(272*)
Primary energy kWh/m2/year			(272*) ÷ (4) =	43.58	(273*)

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	2 Charlotte Street, London, W1T 4QH		

Check	Evidence			Produced by	OK?
Criterion 1: predicted carbon dioxi	de emission fro	om proposed dwellin	g does not exceed the target		
TER (kg CO₂/m².a)	Fuel = Mains g	gas		Authorised SAP Assessor	
	Fuel factor = 1	00			
	TER = 16.42				
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 16.37			Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 16.37 < T	ER 16.42		Authorised SAP Assessor	Passe
Criterion 2: the performance of the	e building fabri	c and the heating, ho	ot water and fixed lighting systems	should be no worse than the design	n limits
Fabric U-values					
Are all U-values better than the	Element	Weighted average	e Highest	Authorised SAP Assessor	Passed
design limits in Table 2?	Wall	0.30 (max 0.30)	0.30 (max 0.70)		
	Party wall	0.00 (max 0.20)	N/A		
	Floor	(no floor)			
	Roof	(no roof)	2.00 (200)		
	Openings	1.60 (max 2.00)	2.00 (max 3.30)		
Thermal bridging					
How has the loss from thermal bridges been calculated?	Thermal bridg reference: tes		user-specified y-value of 0.1, with	Authorised SAP Assessor	
Heating and hot water systems					
Does the efficiency of the heating	Main heating	system:		Authorised SAP Assessor	Passe
systems meet the minimum value			abase		
set out in the Domestic Heating		max 24/2 HE Plus			
Compliance Guide?		9.60% - SEDBUK 2009	1		
	Minimum = 88	3.00%			
	Secondary hea	ating system: None			
Does the insulation of the hot	Cylinder volun	ne = 90.00 litres		Authorised SAP Assessor	Passe
water cylinder meet the standards	•	·	•		
_		mitted cylinder loss			
Compliance Guide?	Primary hot w	rater pipes are insular	ted		
Do controls meet the minimum	Space heating	control:		Authorised SAP Assessor	Passe
controls provision set out in the Domestic Heating Compliance		perature zone contro	ol .		
Guide?	Hot water con				
		k (main system 1)			
	Cylinder thern				
	Separate water	er control			

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comp with paragraphs 42 to 44?	oly Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has app	ropriate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of t	he dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettere in practice?	The following walls/wall have a U-value less than 0.2W/m²K: d) • Part Wall (0.00)	Authorised SAP Assessor	

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	2 Charlotte Street, London, W1T 4QH		

, 10.01.000								
1. Overall dwelling dimens	ions							
		Area (m²)			Average storey height (m)	1	Volume (m³)	)
owest occupied		64.95	(1a) >	<	2.70	(2a) =	175.36	(3a
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	64.95	(4)					
Owelling volume					(3a) + (3b) + (3	3c) + (3d)(3n) =	175.36	(5)
2. Ventilation rate								
							m³ per hour	•
Number of chimneys					0	x 40 =	0	(6a
Number of open flues					0	x 20 =	0	(6b
Number of intermittent fans	3				0	x 10 =	0	(7a
Number of passive vents					0	x 10 =	0	(7b
Number of flueless gas fires					0	x 40 =	0	(7c
							Air changes po	er
nfiltration due to chimneys,	flues, fans, PSVs	(6a) + (6b) + (	7a) + (7b)	+ (7c) =	0	÷ (5) =	0.00	(8)
f a pressurisation test has b	een carried out or is intended, proceed to	o (17), otherw	ise continu	ie from	(9) to (16)			
Air permeability value, q50,	expressed in cubic metres per hour per s	square metre	of envelop	e area			5.00	(17
f based on air permeability	value, then (18) = $[(17) \div 20] + (8)$ , other	wise (18) = (1	6)				0.25	(18
Air permeability value applie	es if a pressurisation test has been done,	or a design or	specified o	air perm	neability is being	used		
Number of sides on which d	welling is sheltered						3	(19
Shelter factor					1	- [0.075 x (19)] =	0.78	(20
Adjusted infiltration rate						(18) x (20) =	0.19	(21
nfiltration rate modified for								
	monthly wind speed:							

Adjusted infiltration	on rate									(18) x (	20) =	0.19	(21)
Infiltration rate me	odified for i	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind speed	from Table	7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m -	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltration	on rate (allo	owing for sh	elter and v	vind speed	) = (21) × (2	22a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	
										∑(22b)1	.12 =	2.62	(22b)

0.50

0.50

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

(23a)

(23b)

If balanced wi				_								77.35	(23c)
a) If balanced					1			1			T	1	<b>-</b>
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air chan	_				1								<b>7</b>
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses ar	nd heat loss	parameter											
The κ-value is the	heat capaci	ty per unit	area, see T	able 1e.									
El	ement		Gross Area, m²	-	nings, n²	Net area A, m²		alue, m²K	A x U, W/K		alue, m².K	Ахк, kJ/K	_
Window*						8.16	x 1.	42 =	11.55	N	/A	N/A	(27)
Doors						2.10	x 2.	00 =	4.20	N	/A	N/A	(26)
External wall						42.61	x 0.	30 =	12.78	N	/A	N/A	(29a)
Party Wall						44.55	x 0.	00 =	0.00	N	/A	N/A	(32)
Total area of exte	rnal elemen	ts ∑A, m²				52.87	(31)						
* for windows and	d roof windo	ws, effecti	ve window	U-value is	calculated	using formเ	la 1/[(1/U\	Value)+0.04	4] paragrap	oh 3.2			
Fabric heat loss, V	$N/K = \sum (A \times A)$	U)							(2	6)(30) + (	32) =	28.53	(33)
Heat capacity Cm	= ∑(A x κ)							(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass par	ameter (TM	P) in kJ/m²	K						Calcula	ted separat	ely =	250.00	(35)
Thermal bridges:	∑(L x Ψ) calc	ulated usir	ng Appendix	κK								5.29	(36)
if details of the	ermal bridgii	ng are not	known then	(36) = 0.1	5 x (31)								
Total fabric heat I	oss									(33) + (	36) =	33.82	(37)
Ventilation heat le			0.33 x (25	)m x (5)							_		_
(38)m	21.69	20.85	20.85	19.17	18.05	17.49	16.93	16.93	18.33	19.17	20.01	20.85	(38)
Heat transfer coe									T	T	T	1	7
(39)m	55.51	54.67	54.67	52.98	51.86	51.30	50.74	50.74	52.14	52.98	53.83	54.67	
	t/IIID) M/	/21/ (20)	(4)						Average =	∑(39)112,	/12 = [	53.01	(39)
Heat loss parame (40)m	0.85	0.84	m ÷ (4)	0.82	0.80	0.79	0.78	0.78	0.80	0.82	0.83	0.84	
(40)111	0.03	0.04	0.04	0.02	0.00	0.73	0.70		!	∑(40)112,		0.82	(40)
													_
4. Water heating	g energy req	uirement											
												:Wh/year	
Assumed occupar	•									2.12	(42	.)	
If TFA > 13.9, N	N = 1 + 1.76 :	x [1 - exp(-0	0.000349 x	(TFA - 13.9	$(9)^2)] + 0.001$	13 x (TFA - 1	3.9)						
If TFA $\leq$ 13.9, N													
Annual average h										84.49			
Annual average h		_		by 5% if th	e dwelling	is designed	to achieve	a water us	e target of	not more ti	han 125 lit	res	
per person per da								_	•			_	
Hot water usage i	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage i (44)m	92.94	89.56	86.18	82.80	79.42	76.04	76.04	79.42	82.80	86.18	89.56	92.94	
(4-4)111	32.34	03.30	00.10	02.00	75.42	70.04	70.04	75.42	02.00	Σ(44)1		1013.91	 ☐ (44)
Energy content of	f hot water i	ısed - calcu	lated mont	hlv = 4 190	) x Vd m x ı	nm x Tm/36	00 kWh/i	month (see	Tables 1b			1013.31	
(45)m	138.16	120.84	124.69	108.71	104.31	90.01	83.41	95.71	96.86	112.88	123.21	133.80	
. ,		-			-		i <u> </u>	1	1	Σ(45)1		1332.58	(45)
If instantaneous v	vater heatin	g at point o	of use (no h	ot water si	torage), en	ter 0 in box	es (46) to (6	51)		_( -/		<del>-</del>	、 ~/
For community he								•					
Distribution loss	0.15 x (45)m	ı											
(46)m	20.72	18.13	18.70	16.31	15.65	13.50	12.51	14.36	14.53	16.93	18.48	20.07	(46)
												te Street v	

Heat gains from water heating, kWh/month  $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$ 79.46 (65)m 85.72 76.11 81.24 74.64 74.46 68.42 67.51 70.70 77.31 84.27 (65)

	lon	Fala	Max	Λ	May	lum	Lul	Λα	Com	Oct	Nov	Doo	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5), Wa	atts											_
(66)m	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	(66
Lighting gains (c	alculated in A	Appendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	45.36	40.29	32.77	24.81	18.54	15.65	16.91	21.99	29.51	37.47	43.73	46.62	(67
Appliances gains	s (calculated	in Appendix	L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	276.47	279.34	272.11	256.72	237.29	219.03	206.83	203.97	211.19	226.59	246.01	264.27	(68
Cooking gains (c	alculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	(69
Pumps and fans	gains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70
Losses e.g. evap	oration (nega	ative values	) (Table 5)										
(71)m	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	(71
	Water heating gains (Table 5)												
Water heating g	ains (Table 5	,											

#### 6. Solar gains

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

		Access facto Table 6d	or	Area m²	So	lar flux W/	m² g	g Specific data or Table 6b		FF Specific dat or Table 6c	ta	Gains (W)	)
Northeast		0.77	] x	4.80	x	11.51	x 0.9 x	0.63	х	0.70	=	16.88	(7
Southwest		0.77	] x	1.12	x	37.39	x 0.9 x	0.63	x	0.70	=	12.80	(
Southeast		0.77	] x	2.24	x	37.39	x 0.9 x	0.63	x	0.70	=	25.59	(
Solar gains in watt	ts, calculate	ed for each	month ∑(7	4)m(82)m									
(83)m	55.28	100.00	146.81	205.72	248.06	261.16	252.22	218.80	170.57	117.73	67.34	46.54	(
Гotal gains - interr	nal and sol	ar (73)m + (8	83)m										
(84)m	594.50	635.06	663.05	693.09	706.16	693.06	668.88	643.17	611.64	587.87	569.63	572.87	(
7 Maan intagraal	townough	uus (haatins	~										
7. Mean internal													٦,
emperature duri	_		_									21.00	_] (
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Jtilisation factor f (86)m	0.98	0.96	, η1,m (see	0.84	0.67	0.47	0.31	0.32	0.57	0.83	0.96	0.98	٦ (
		-1			0.67	0.47	0.51	0.52	0.57	0.65	0.90	0.96	(
Леап internal ten (87)m	20.57	20.66	20.77	20.88	20.95	20.96	20.96	20.96	20.96	20.90	20.72	20.59	٦ (
emperature duri		-					20.50	20.50	20.50	20.50	20.72	20.55	۱ ر
(88)m	20.21	20.22	20.22	20.24	20.26	20.26	20.27	20.27	20.25	20.24	20.23	20.22	7 (
Jtilisation factor f		-1						20.27					_ ' _
(89)m	0.97	0.95	0.91	0.81	0.62	0.42	0.26	0.27	0.50	0.79	0.94	0.97	٦ (
Mean internal ten		-											۰ ــ
(90)m	19.65	19.78	19.93	20.10	20.18	20.20	20.21	20.21	20.19	20.12	19.87	19.68	7 (
iving area fractio	n							fLA 29	9.40	÷ (4) =		0.45	_ ] (
/lean internal ten	nperature 1	for the whol	le dwelling	fLA x T1 +(1	L - fLA) x T2	2							
(92)m	20.07	20.17	20.31	20.45	20.53	20.55	20.55	20.55	20.54	20.47	20.26	20.09	7 (
apply adjustment	to the mea	an internal t	emperatur	re from Tabl	le 4e, wher	e appropri	ite	•				•	_
(93)m	19.92	20.02	20.16	20.30	20.38	20.40	20.40	20.40	20.39	20.32	20.11	19.94	(
8. Space heating													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
et Ti to the mean			obtained a	at step 11 of	f Table 9b,	so that tim	= (93)m a	ind recalculate	the ut	ilisation factor	for gains	using Table	e 9
Jtilisation factor f (94)m	0.97	0.95	0.90	0.81	0.63	0.43	0.27	0.28	0.52	0.79	0.94	0.97	7 (
Jseful gains, ŋmG				0.81	0.03	0.43	0.27	0.20	0.52	0.73	0.54	0.37	\
(95)m	575.72	603.40	599.90	562.85	442.26	296.84	177.66	177.65	315.58	467.23	536.22	555.13	7 (
Monthly average					112.20	230.01	177.00	177.03	313.30	107.23	330.22	333.13	۱ ر
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	7 (
leat loss rate for		!			1, 0		20.00		250	1 23.00			_ \
	855.85	821.30	730.49	614.66	450.14	297.35	177.67	177.67	317.39	504.57	705.46	822.44	7 (
(97)111										1 - 1		1	, د
(97)m bace heating req					^ [(~,/)]	(22)111] ^	· -/···						
pace heating req					5.86	0.00	0.00	0.00	0.00	27.78	121.86	198.88	
	208.42	146.43	97.16	37.31	5.86	0.00	0.00 Total per	0.00 year (kWh/ye		27.78		198.88 843.70	] ] (

9a. Energy Requ	uirements - I	Individual h	neating syst	tems includ	ling micro-	СНР							
Space heating:													
Fraction of space	heating fro	m secondar	y/supplem	entary syst	em (Table 1	11)			0.00	(201)			
Fraction of space	heating fro	m main sys	tem(s) 1-	(201)					1.00	(202)			
Fraction of main	heating fron	n main syst	em 2						0.00	(203)			
Fraction of total s	space heat f	rom main s	ystem 1 (2	02) x [1 - (2	03)]				1.00	(204)			
Fraction of total s					,-				0.00	(205)			
Efficiency of mair				- , (,					90.60	(206)			
(from database o				propriate by	the amou	nt shown in	the 'space				f Table 4c)		
(). c aata2 acc c	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating red	quirement, l	kWh/month	n (as calcula	ited above)	•								
(98)m	208.42	146.43	97.16	37.31	5.86	0.00	0.00	0.00	0.00	27.78	121.86	198.88	
Space heating fue	el (main hea	ting system	1), kWh/m	nonth = (98	)m x (204) :	x 100 ÷ (206	5)						
(211)m	230.04	161.62	107.24	41.18	6.47	0.00	0.00	0.00	0.00	30.66	134.50	219.52	
						Т	otal per y	ear (kWh/y	ear) = ∑(2:	11)15, 10	.12 =	931.23	(211)
Water heating:													
Output from wat	er heater, k	Wh/month	(calculated	d above)									
(64)m	187.88	165.75	174.42	156.83	154.03	138.13	133.13	145.44	144.98	162.60	171.33	183.52	
										∑(64)1	.12 = 2	1918.04	(64)
Efficiency of wate	er heater pe	r month											
(217)m	85.19	84.59	83.42	81.76	80.25	79.90	79.90	79.90	79.90	81.30	84.02	85.13	
Fuel for water he	eating, kWh/	month = (6	4)m x 100 ÷	÷ (217)m									
(219)m	220.54	195.95	209.07	191.83	191.95	172.88	166.62	182.02	181.45	200.00	203.91	215.58	
							Tota	al per year (	kWh/year	) = ∑(219)1	.12 = 2	2331.80	(219)
Annual Totals Su	mmary:									kWh/yo	ear k	Wh/year	
Space heating fu	el used, ma	in system 1										931.23	(211)
Water heating fu		•										2331.80	(219)
Electricity for pur	mps, fans aı	nd electric l	keep-hot (T	able 4f):									
mechanical ve	•				nput from	outside				106.9	7		(230a)
warm air heat										0.00			(230b
central heatin										130.0	0		(230c)
oil boiler pum	р									0.00			(230d
boiler flue fan	1									45.00	)		(230e)
maintaining e	lectric keep	-hot facility	for gas con	nbi boiler						0.00			(230f)
pump for sola		7								0.00			(230g)
Total electricity for	or the above	9								∑(230a)(2	230g)	281.97	(231)
													7
Electricity for ligh	hting (calcul	ated in App	oendix L):									320.44	(232)
10a. Fuel costs -	- Ind <u>ividual</u>	heating sys	tems includ	ding micro-	CHP								
		3-7				kWh/vear		Fi	uel price		Fuel	cost £/vea	r

10a. Fuel costs - Individual heating systems including micro	o-CHP					
	Fuel kWh/year		Fuel price (Table 12)		Fuel cost £/year	
Space heating - main system 1	931.23	х	3.10	x 0.01 =	28.87	(240)
Water heating cost (other fuel)	2331.80	х	3.10	x 0.01 =	72.29	(247)
Pumps, fans and electric keep-hot	281.97	х	11.46	x 0.01 =	32.31	(249)
Energy for lighting	320.44	х	11.46	x 0.01 =	36.72	(250)
Additional standing charges (Table 12)					106.00	(251)
Total energy cost			(240)(242	) + (245)(254)	276.19	(255)

11a. SAP rating - Individual heating systems including micro-CHP		
Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] = $ 1.18	(257)
SAP value	83.53	
SAP rating	84	(258)
SAP band	В	

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	931.23	x	0.198	=	184.38	(261)
Water heating	2331.80	x	0.198	=	461.70	(264)
Space and water heating			(261) + (262) +	- (263) + (264) =	646.08	(265)
Pumps, fans and electric keep-hot	281.97	x	0.517	=	145.78	(267)
Lighting	320.44	x	0.517	=	165.67	(268)
Total carbon dioxide emissions				∑(261)(271) =	957.53	(272)
Dwelling carbon dioxide emissions rate				(272) ÷ (4) =	14.74	(273)
El value					88.33	
El rating (see section 14)					88	(274)
EI band					В	]

	Energy kWh/year		Primary Energy Factor	Primary Energy		
Space heating - main system 1	931.23	Х	1.02	=	949.86	(261*)
Water heating	2331.80	х	1.02	=	2378.43	(264*)
Space and water heating			(261*) + (262*) + (2	63*) + (264*) =	3328.29	(265*)
Pumps, fans and electric keep-hot	281.97	х	2.92	=	823.36	(267*)
Lighting	320.44	х	2.92	=	935.67	(268*)
Total primary energy kWh/year			∑(2	261*)(271*) =	5087.32	(272*)
Primary energy kWh/m2/year				(272*) ÷ (4) =	78.33	(273*)

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	2 Charlotte Street, London, W1T 4QH		

Check	Evidence			Produced by	OK?
Criterion 1: predicted carbon dioxi	de emission from prop	osed dwellin	g does not exceed the target		
TER (kg CO₂/m².a)	Fuel = Mains gas Fuel factor = 1.00 TER = 16.42			Authorised SAP Assessor	
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 10.72			Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 10.72 < TER 16.4	2		Authorised SAP Assessor	Passe
Criterion 2: the performance of the	building fabric and th	ne heating, ho	ot water and fixed lighting syster	ms should be no worse than the design	n limits
Fabric U-values					
Are all U-values better than the design limits in Table 2?	Wall 0.20 Party wall 0.00 Floor (no fl Roof (no re		e Highest 0.20 (max 0.70) N/A 2.00 (max 3.30)	Authorised SAP Assessor	Passe
Thermal bridging					
How has the loss from thermal bridges been calculated?	Thermal bridging calc	ulated using	default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems					
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Mains gas, Regular bo Potterton Promax 24, Efficiency = 89.60% - : Minimum = 88.00%	oiler from dat /2 HE Plus SEDBUK 2009		Authorised SAP Assessor	Passe
Does the insulation of the hot	Secondary heating sys Cylinder volume = 90.			Authorised SAP Assessor	Passe
water cylinder meet the standards set out in the Domestic Heating Compliance Guide?		= 1.14kWh/d cylinder loss	= 1.41kWh/day		- 3000
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance	Space heating control Time and temperatur		ol	Authorised SAP Assessor	Passe
Guide?	Hot water control: Boiler interlock (main Cylinder thermostat	system 1)			
	Separate water contr	ol			

Check	Evidence	Produced by	ОК?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appro	priate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of the	e dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.2W/m <sup>2</sup> • Part Wall (0.00) Use of the following low carbon or renewable technologie • Photovoltaic array		

### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	2 Charlotte Street, London, W1T 4QH		

Address	2 Charlotte Sti	eet, London, W11 40	• •						
1. Overall dwelling dimens	ions								
			Area (m²)			Average stor height (m)	•	Volume (m³	)
owest occupied			64.95	(1a) x		2.70	(2a) =	175.36	(3
otal floor area	(1a) + (1	b) + (1c) + (1d)(1n)	= 64.95	(4)					
Owelling volume						(3a) + (3b) +	(3c) + (3d)(3n) =	175.36	(5)
2. Ventilation rate									
								m³ per hour	
lumber of chimneys						0	x 40 =	0	(6
lumber of open flues						0	x 20 =	0	(6
lumber of intermittent fans	;					0	x 10 =	0	(7
lumber of passive vents						0	x 10 =	0	(7
lumber of flueless gas fires						0	x 40 =	0	(7
								Air changes p hour	er
nfiltration due to chimneys,	flues, fans, PSV	s	(6a) + (6b) +	(7a) + (7b) +	(7c) =	0	÷ (5) =	0.00	(8
a pressurisation test has b	een carried out o	or is intended, procee	d to (17), otherv	vise continu	e from (	(9) to (16)			
ir permeability value, q50,	expressed in cub	oic metres per hour p	er square metre	of envelope	e area			5.00	(1
based on air permeability	value, then (18)	= [(17) ÷ 20] + (8), otl	nerwise (18) = (1	.6)				0.25	(1
ir permeability value applie	es if a pressurisa	tion test has been do	ne, or a design o	r specified a	ir perm	eability is bei	ng used		
lumber of sides on which d	welling is shelter	red						3	(1
helter factor							1 - [0.075 x (19)] =	0.78	(2
Adjusted infiltration rate							(18) x (20) =	0.19	(2
nfiltration rate modified for	monthly wind s	peed:							
Jan	Feb I	Mar Apr	May Jun	Jul	Α	ug Sep	Oct N	lov Dec	

Adjusted infiltrati	on rate									(18) x (	20) =	0.19	(21)
Infiltration rate m	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind speed	from Table	2 7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	)m = (22)m ·	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltrati	on rate (allo	owing for sh	nelter and v	vind speed	) = (21) × (2	2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	
										∑(22b)1	.12 =	2.62	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

If balanced wit	:h heat recc	overy: effici	ency in % a	allowing for	in-use fact	or (from Ta	able 4h) =					77.35	(23c)
a) If balanced	mechanical	ventilation	with heat	recovery (N	//VHR) (22	(23b)m +	) x [1 - (23c	) ÷ 100] =					_
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air chang	ge rate - en	ter (24a) or	(24b) or (2	24c) or (24d	) in box (25	5)				_	_		_
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses ar	nd heat loss	parametei											
The κ-value is the	heat capac	ity per unit	area, see	Table 1e.									
EI	ement		Gross Area, m²		nings, n²	Net area A, m²		alue, m²K	A x U, W/K		alue, /m².K	Ахк, kJ/K	_
Window*						8.16	x 1.	42 =	11.55		N/A	N/A	(27)
Doors						2.10	x 2.	00 =	4.20		N/A	N/A	(26)
External wall						42.61	x 0.	20 =	8.52		N/A	N/A	(29a)
Party Wall						44.55	x 0.	00 =	0.00		N/A	N/A	(32)
Total area of exte	rnal elemer	nts ∑A, m²				52.87	(31)						
* for windows and	d roof wind	ows, effecti	ve window	U-value is	calculated	using form	ula 1/[(1/U	Value)+0.0	4] paragra <sub>l</sub>	oh 3.2			
Fabric heat loss, V	$V/K = \sum (A \times$	U)							(2	26)(30) +	(32) =	24.27	(33)
Heat capacity Cm	= Σ(A x κ)							(28)	.(30) + (32)	+ (32a)(	32e) =	N/A	(34)
Thermal mass par	ameter (TM	1P) in kJ/m²	K						Calcula	ted separa	tely =	250.00	(35)
Thermal bridges:	∑(L x Ψ) cal	culated usir	ng Append	ix K								7.93	(36)
if details of the	ermal bridgi	ing are not	known the	n (36) = 0.1	5 x (31)								
Total fabric heat l	oss									(33) +	(36) =	32.20	(37)
Ventilation heat lo	oss calculat	ed monthly	0.33 x (2	5)m x (5)									_
(38)m	21.69	20.85	20.85	19.17	18.05	17.49	16.93	16.93	18.33	19.17	20.01	20.85	(38)
Heat transfer coef		1				10.50	10.10	10.10		T			7
(39)m	53.89	53.05	53.05	51.37	50.25	49.69	49.12	49.12	50.53	51.37	52.21	53.05	] 7
Heat loss paramet	ter (HLP), W	//m²K (39)	m ÷ (4)						Average =	∑(39)112	2/12 =	51.39	(39)
(40)m	0.83	0.82	0.82	0.79	0.77	0.76	0.76	0.76	0.78	0.79	0.80	0.82	
									Average =	∑(40)112	2/12 =	0.79	(40)
4. Water heating	g energy red	quirement											
	,											kWh/year	
Assumed occupar	icv. N									2.1			
If TFA > 13.9, N		x [1 - exp(-	0.000349 x	(TFA - 13.9	))²)] + 0.00′	13 x (TFA - 1	13.9)					-,	
If TFA ≤ 13.9, N		n [2 chp(		. (	7 71 * 0.00.	20 / (	20.57						
Annual average h		age in litres	ner day V	d.average =	(25 x N) +	36				84.4	.9 (4:	3)	
Annual average h							to achieve	a water us	e target of				
per person per da	y (all water	use, hot an	d cold)	, , , , ,		,			- · · · · · · · · · · · · · · · · · · ·				
Hak water	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage i (44)m	92.94	89.56	86.18	82.80	79.42	76.04	76.04	79.42	82.80	86.18	89.56	92.94	٦
(44)111	32.34	83.30	80.18	82.80	75.42	70.04	70.04	75.42	82.80	Σ(44)1		1013.91	 ☐ (44)
Energy content of	hot water	nseq - calci	lated mon	thly = 4 100	) v Vd m v i	nm v Tm/24	500 KWK/	month (sa	Tahlar 1h		12 -	1013.71	(++)
(45)m	138.16	120.84	124.69	108.71	104.31	90.01	83.41	95.71	96.86	112.88	123.21	133.80	
V = V				1	1	1 3332	1 22		, , , , , ,	Σ(45)1		1332.58	_ ☐ (45)
If instantaneous v	vater heatir	ng at point o	of use (no l	hot water si	torage), en	ter 0 in box	es (46) to (	61)		2( .5/1			_ 、 -/
For community he		-						•					
Distribution loss (	0.15 x (45)n	n											
(46)m	20.72	18.13	18.70	16.31	15.65	13.50	12.51	14.36	14.53	16.93	18.48	20.07	(46)
												e SteetPV vo sessor version	

if (64)m < 0 then set to 0

Heat gains from water heating, kWh/month  $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$ (65)m 85.72 76.11 81.24 74.64 74.46 68.42 67.51 71.60 70.70 77.31 79.46 84.27 (65)

5. Internal gains	s (see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (	Table 5), Wa	atts											
(66)m	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	127.06	(66)
Lighting gains (ca	Iculated in A	Appendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	45.36	40.29	32.77	24.81	18.54	15.65	16.91	21.99	29.51	37.47	43.73	46.62	(67)
Appliances gains	(calculated i	in Appendix	L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	276.47	279.34	272.11	256.72	237.29	219.03	206.83	203.97	211.19	226.59	246.01	264.27	(68)
Cooking gains (ca	lculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	49.82	(69)
Pumps and fans g	gains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evapo	ration (nega	ative values	) (Table 5)										
(71)m	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	-84.70	(71)
Water heating ga	ins (Table 5)	)											
(72)m	115.21	113.26	109.19	103.67	100.08	95.03	90.74	96.24	98.19	103.91	110.37	113.26	(72)

#### 6. Solar gains

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

	А	ccess facto Table 6d	r	Area m²	So	lar flux W/	m² g	g Specific da or Table 6b		FF Specific da or Table 60		Gains (W)	)
Northeast		0.77	x	4.80	x	11.51	x 0.9 x	0.63	x	0.70	=	16.88	(7
Southwest		0.77	x	1.12	x	37.39	x 0.9 x	0.63	x	0.70	=	12.80	(
Southeast		0.77	x	2.24	x	37.39	x 0.9 x	0.63	x	0.70	=	25.59	(
Solar gains in watts, c	alculate	d for each i	month ∑(7	4)m(82)m									
(83)m	5.28	100.00	146.81	205.72	248.06	261.16	252.22	218.80	170.57	117.73	67.34	46.54	] (
Гotal gains - internal a	nd sola	r (73)m + (8	33)m										
(84)m 5	94.50	635.06	663.05	693.09	706.16	693.06	668.88	643.17	611.64	587.87	569.63	572.87	(
7. Mean internal ter	nperatu	re (heating	; season)										
Temperature during h	eating p	periods in t	ne living ar	ea from Tal	ble 9, Th1(˚	°C)						21.00	] (
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for g	ains for	living area	η1,m (see	Table 9a)									_
(86)m	0.98	0.96	0.92	0.83	0.65	0.46	0.30	0.31	0.55	0.82	0.95	0.98	
Aean internal temp o	f living a	area T1 (ste	ps 3 to 7 ii	n Table 9c)									_
(87)m	20.60	20.68	20.79	20.89	20.95	20.96	20.96	20.96	20.96	20.91	20.74	20.62	
emperature during h	eating p	periods in t	ne living ar	ea from Ta	ble 9, Th2(	°C)							_
(88)m	20.23	20.24	20.24	20.26	20.28	20.28	20.29	20.29	20.27	20.26	20.25	20.24	
Itilisation factor for g													_
(89)m	0.97	0.95	0.90	0.80	0.60	0.41	0.25	0.26	0.49	0.78	0.94	0.97	(
Aean internal temper											T	1	7
(90)m	.9.71	19.83	19.98	20.13	20.21	20.23	20.24	20.24	20.21	20.15	19.93	19.74	_] (
iving area fraction								fLA	29.40	÷ (4) =	=	0.45	] (
Mean internal temper						1		1	1	1	ı	1	٦.
` '	0.11	20.22	20.35	20.48	20.55	20.56	20.56	20.56	20.55	20.50	20.30	20.14	_] (
Apply adjustment to t								1		1		1	٦,
(93)m	.9.96	20.07	20.20	20.33	20.40	20.41	20.41	20.41	20.40	20.35	20.15	19.99	_] (
8. Space heating req	uireme	nt											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
et Ti to the mean int								_	•				e 9
Jtilisation factor for g	ains, ηn	n											
(94)m	0.97	0.95	0.90	0.80	0.61	0.42	0.26	0.27	0.50	0.78	0.94	0.97	] (
Jseful gains, ηmGm,	N = (94)	)m x (84)m											
(95)m 5	74.49	601.09	595.27	554.05	430.96	288.29	172.65	172.64	306.94	459.46	533.67	553.92	] (
Monthly average exte	rnal ten	nperature f	rom Table	8									
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(
leat loss rate for mea	n interr	nal tempera	iture, Lm, \	W									
(97)m 8	33.36	799.30	710.81	597.26	436.92	288.64	172.66	172.66	308.25	490.36	686.29	800.48	] (
Space heating require	ment fo	r each mor	nth, kWh/n	nonth = 0.0	24 x [(97)n	n - (95)m] x	(41)m						
(98)m 1	92.60	133.20	85.96	31.11	4.43	0.00	0.00	0.00	0.00	22.99	109.88	183.45	
							Tatal	waar (k\A/b/	(00r) - 5/	00)1 F 10	12	762.62	7 (
							rotal per	year (Kvvii/)	/ear) = <u>&gt;</u> (	98)15, 10	.12 =	763.62	\

9a. Energy Requ	irements - I	Individual h	neating sys	tems includ	ding micro-	СНР							
Space heating:													
Fraction of space	heating from	m secondar	y/supplem	entary syst	em (Table :	11)			0.00	(201)			
Fraction of space	_				•	•			1.00	(202)			
Fraction of main h	_			` ,					0.00	(203)			
Fraction of total s	· ·	,		.02) x [1 - (2	203)]				1.00	(204)			
Fraction of total s									0.00	(205)			
Efficiency of main				.02) X (203)					90.60	(206)			
(from database or	•	•		nronriate h	y the amou	nt shown ii	n the 'snace	efficiency			ahle 4c)		
grom database or	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating req				•	-								
(98)m	192.60	133.20	85.96	31.11	4.43	0.00	0.00	0.00	0.00	22.99	109.88	183.45	
Space heating fue	el (main hea	ting system	1), kWh/n	nonth = (98	)m x (204) :	x 100 ÷ (20	6)						
(211)m	212.58	147.02	94.88	34.34	4.89	0.00	0.00	0.00	0.00	25.38	121.28	202.48	
						-	Total per ye	ar (kWh/y	vear) = ∑(21	1)15, 101	2 = 842	2.84	(211)
Water heating:													
Output from water	er heater, k\	Wh/month	(calculated	d above)									
(64)m	187.88	165.75	174.42	156.83	154.03	138.13	133.13	145.44	144.98	162.60	171.33	183.52	
										∑(64)11	2 = 191	8.04	(64)
Efficiency of wate	er heater pe	r month											
(217)m	84.98	84.34	83.14	81.49	80.16	79.90	79.90	79.90	79.90	81.09	83.77	84.91	
Fuel for water hea	ating, kWh/	month = (6	4)m x 100 ÷	÷ (217)m									
(219)m	221.09	196.53	209.78	192.44	192.15	172.88	166.62	182.02	181.45	200.53	204.54	216.13	
							Total	per year	(kWh/year)	= ∑(219)11i	2 = 233	6.16	(219)
Annual Totals Sur	-	_								kWh/yea		/year	
Space heating fue	el used, mai	in system 1								kWh/yea	842	2.84	
Space heating fue Water heating fue	el used, mai	-								kWh/yea	842		
Space heating fue	el used, mai	-		Γable 4f):						kWh/yea	842	2.84	
Space heating fue Water heating fue Electricity for pur mechanical ve	el used, mai el used mps, fans ar	nd electric l	keep-hot (1		input from	outside				106.97	842	2.84	(219) (230a
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heati	el used, mai el used mps, fans ar entilation far ing system f	nd electric l	keep-hot (1		input from	outside				106.97	842	2.84	(219) (230a (230b
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating central heating	el used, mai el used mps, fans ar entilation far ing system f	nd electric l	keep-hot (1		input from	outside				106.97 0.00 130.00	842	2.84	(230a (230a (230a (230a
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating central heating oil boiler pump	el used, mai el used mps, fans ar entilation far ing system f g pump p	nd electric l	keep-hot (1		input from	outside				106.97 0.00 130.00 0.00	842	2.84	(230a (230a (230a (230a (230a
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating central heating oil boiler pump boiler flue fan	el used, mai el used mps, fans ar entilation far ing system f g pump p	nd electric I ns - balance fans	keep-hot (1	or positive i	input from	outside				106.97 0.00 130.00 0.00 45.00	842	2.84	(230a (230a (230a (230a (230a
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele	el used, mai el used mps, fans ar entilation far ing system f g pump p	nd electric l ns - balance fans -hot facility	keep-hot (1	or positive i	input from	outside				106.97 0.00 130.00 0.00 45.00 0.00	842	2.84	(230a (230a (230a (230a (230a (230a (230a
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating central heating oil boiler pump boiler flue fan	el used, mai el used mps, fans ar entilation far ing system f g pump p	nd electric I ns - balance fans -hot facility ting	keep-hot (1	or positive i	input from	outside				106.97 0.00 130.00 0.00 45.00	233	2.84	(230a (230a (230a (230a (230a (230a (230a (230a (230a
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for	el used, mai el used mps, fans ar entilation far ing system f g pump p lectric keep- r water hear or the above	nd electric lance fans -hot facility ting	keep-hot (1	or positive i	input from	outside				106.97 0.00 130.00 0.00 45.00 0.00 0.00	233 233 0g) 283	2.84 6.16	(230a (230b (230c (230c (230e (230f (230g (231)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar	el used, mai el used mps, fans ar entilation far ing system f g pump p lectric keep- r water hear or the above	nd electric lance fans -hot facility ting	keep-hot (1	or positive i	input from	outside				106.97 0.00 130.00 0.00 45.00 0.00 0.00	233 233 0g) 283	2.84 6.16	(230a (230b (230c (230c (230c (230f (230g (231)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for	el used, mai el used mps, fans ar entilation far ing system f g pump p lectric keep- r water hear or the above	nd electric lans - balance fans -hot facility ting	keep-hot (1 ed, extract of for gas cor	or positive i		outside				106.97 0.00 130.00 0.00 45.00 0.00 0.00	233 233 0g) 283	2.84 6.16	(230a (230b (230c (230d (230e (230f) (230g
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining el- pump for solar Total electricity for	el used, mainel used mps, fans are entilation far ing system to g pump pump pump pump pump pump pump pu	nd electric lans - balance fans -hot facility ting e	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic	or positive i	d Q):	outside				106.97 0.00 130.00 0.00 45.00 0.00 0.00	233 233 20g) 283	2.84 6.16	(230a (230b (230c (230c (230e (230f (230g (231)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for Electricity for light Energy saving/get	el used, mainel used mps, fans an entilation far ing system fing pump pump pump pump pump pump pump pum	nd electric land	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q):	outside				106.97 0.00 130.00 0.00 45.00 0.00 0.00	233 233 20g) 283	2.84 6.16 1.97	(230a (230a (230a (230a (230a (230a (230f (230g (231)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining el- pump for solar Total electricity for Electricity for ligh Energy saving/ger Electricity generate	el used, mainel used mps, fans an entilation far ing system fing pump pump pump pump pump pump pump pum	nd electric land	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q):	outside kWh/year			uel price	106.97 0.00 130.00 0.00 45.00 0.00 0.00	842 233 233 00g) 282 320	2.84 6.16 1.97	(230a (230a (230a (230a (230a (230f (230g (231)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for Electricity for ligh Energy saving/get Electricity generat	el used, mai el used mps, fans ar entilation far ing system f g pump p lectric keep- r water hea or the above nting (calcul eneration te ted by PVs (	nd electric kens - balance fans -hot facility ting electrologies (Appendix Neating sys)	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q): CHP	kWh/year	1		uel price Table 12)	106.97 0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(230	233 233 209) 283 320 -65	2.84 6.16 1.97 0.44 7.28	(219) (230a (230a (230a (230a (230a (230a (230f (230g (231) (232)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining el- pump for solar Total electricity for Electricity for ligh Energy saving/ge Electricity generat  10a. Fuel costs -	el used, mainel used mps, fans are entilation far entilation teres en	nd electric lens - balance fans  -hot facility ting electrologies (Appendix Meating sys)	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q): CHP	kWh/year 842.84	] x		uel price Table 12)	106.97 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230	233 233 233 233 209) 283 320 -65  Fuel cos	2.84 6.16 1.97 0.44 7.28	(219) (230a (230a (230a (230a (230a (230a (230a (231) (232) (233)
Space heating fue Water heating fue Electricity for pure mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for Electricity for light Energy saving/get Electricity general  10a. Fuel costs -	el used, mainel used mps, fans are entilation far ing system ing pump pump pump pump pump pump pump pum	nd electric kens - balance fans -hot facility ting electrologies (Appendix Meating system)	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q): CHP Fuel	kWh/year 842.84 336.16	] x		uel price Table 12) 3.10 3.10	106.97 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230a) x 0.01 = x 0.01 =	233 233 233 233 233 233 233 233 233 233	2.84 6.16 1.97 0.44 7.28 st £/year	(219) (230a (230b (230c (230e (230f) (230g (231) (232) (233)
Space heating fue Water heating fue Electricity for pur mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for Electricity for ligh Energy saving/ge Electricity general  10a. Fuel costs -	el used, mainel used mps, fans are entilation far e	nd electric kens - balance fans -hot facility ting electrologies (Appendix Meating system)	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q):  CHP  Fuel	kWh/year 842.84 336.16 281.97	] x x x x x		uel price Table 12) 3.10 3.10 11.46	106.97 0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(230a) x 0.01 = x 0.01 =	842 233 233 209) 283 320 -65  Fuel cos 26 72 32	2.84 6.16 1.97 0.44 7.28 st £/year 5.13 42	(219) (230a (230b (230c (230e (230f (230g (231) (232) (233)
Space heating fue Water heating fue Electricity for pure mechanical ve warm air heating oil boiler pump boiler flue fan maintaining ele pump for solar Total electricity for Electricity for light Energy saving/get Electricity general  10a. Fuel costs -	el used, mainel used  mps, fans are entilation fare ing system fare pump  p  lectric keeper water hear or the above inting (calculated by PVs (individual individual	nd electric land	keep-hot (1 ed, extract of for gas cor pendix L): (Appendic M) (negative	or positive i mbi boiler es M, N and e quantity)	d Q):  CHP  Fuel	kWh/year 842.84 336.16	] x		uel price Table 12) 3.10 3.10	106.97 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230a) x 0.01 = x 0.01 =	842 233 233 209) 283 320 -65 Fuel cos 26 72 32 36	2.84 6.16 1.97 0.44 7.28 st £/year	(219) (230a (230b (230c (230e (230f) (230g (231) (232) (233)

Energy saving/generation technologies (Appendices M, N					_
PV savings (negative quantity)	-657.28	Х	11.46 x 0.01 =	-75.32	(252
Total energy cost			(240)(242) + (245)(254)	198.26	(255
11a. SAP rating - Individual heating systems including mid	cro-CHP				
Energy cost deflator (Table 12)				0.47	(256
Energy cost factor (ECF)			[(255) x (256)] ÷ [(4) + 45.0] =	0.85	(257
SAP value				88.18	]
SAP rating				88	(258
SAP band				В	]
12a. Carbon dioxide emissions - Individual heating system	ns including micro-CHP				
	Energy kWh/year		Emissions Factor	Emissions (kgCO2/year)	
Space heating - main system 1	842.84	х	0.198 =	166.88	(261
Water heating	2336.16	x	0.198 =	462.56	(264
Space and water heating			(261) + (262) + (263) + (264) =	629.44	(26
Pumps, fans and electric keep-hot	281.97	x	0.517 =	145.78	(26
Lighting	320.44	x	0.517 =	165.67	(268
Energy saving/generation technologies:					
PV emission savings (negative quantity)	-657.28	x	0.529 =	-347.70	(269
Total carbon dioxide emissions			∑(261)(271) =	593.19	(27
Dwelling carbon dioxide emissions rate			(272) ÷ (4) =	9.13	(273
El value				92.77	]
El rating (see section 14)				93	(274
EI band				А	]
13a. Primary energy - Individual heating systems includin	ng micro-CHP				
	Energy kWh/year		Primary Energy Factor	Primary Energy	,
Space heating - main system 1	842.84	x	1.02 =	859.70	(261
Water heating	2336.16	x	1.02 =	2382.88	(264
Space and water heating			(261*) + (262*) + (263*) + (264*) =	3242.58	(26
Pumps, fans and electric keep-hot	281.97	Х	2.92 =	823.36	(26
Lighting	320.44	Х	2.92 =	935.67	(268
Energy saving/generation technologies:					
PV primary energy savings (negative quantity)	-657.28	Х	2.92 =	-1919.26	(26
Total primary energy kWh/year			∑(261*)(271*) =	3082.35	(27
Primary energy kWh/m2/year			(272*) ÷ (4) =	47.46	(27

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	3 Charlotte Street, London, W1T 4QH		

Check	Evidence			Produced by	OK?			
Criterion 1: predicted carbon dioxi	de emission fro	om proposed dwellin	g does not exceed the target					
TER (kg CO₂/m².a)	Fuel = Mains g Fuel factor = 1 TER = 16.29	•		Authorised SAP Assessor				
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 16.25			Authorised SAP Assessor				
Are emissions from dwelling as designed less than or equal to the target?	DER 16.25 < T	ER 16.29		Authorised SAP Assessor Passe				
Criterion 2: the performance of the	e building fabri	c and the heating, ho	ot water and fixed lighting systems	should be no worse than the design	n limits			
Fabric U-values								
Are all U-values better than the design limits in Table 2?	Element Wall Party wall Floor Roof Openings	Weighted average 0.30 (max 0.30) 0.00 (max 0.20) (no floor) (no roof) 1.56 (max 2.00)	e <b>Highest</b> 0.30 (max 0.70) N/A  2.00 (max 3.30)	Authorised SAP Assessor	Passed			
Thermal bridging								
How has the loss from thermal bridges been calculated?	Thermal bridg reference: Tes	ring calculated using ( st	Authorised SAP Assessor					
Heating and hot water systems								
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Mains gas, Re Potterton Pro Efficiency = 89 Minimum = 88	gular boiler from data max 24/2 HE Plus 9.60% - SEDBUK 2009 8.00%		Authorised SAP Assessor	Passed			
Does the insulation of the hot	•	ating system: None me = 180.00 litres		Authorised SAP Assessor	Passe			
water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Nominal cylin Maximum per		= 2.10kWh/day					
Oo controls meet the minimum controls provision set out in the Domestic Heating Compliance		perature zone contro	ol	Authorised SAP Assessor	Passe			
Guide?	Hot water cor Boiler interloo Cylinder therr	ck (main system 1)						

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comp with paragraphs 42 to 44?	oly Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has app	ropriate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of t	he dwelling, as designed, is consistent with the DER		
Design air permeability $(m^3/(h.m^2)$ at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettere in practice?	The following walls/wall have a U-value less than 0.2W/m²K: d) • Part Wall (0.00)	Authorised SAP Assessor	

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	3 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimensions							
		Area (m²)		Average storey height (m)		Volume (m³)	
Lowest occupied		98.16	(1a) x	3.10	(2a) =	304.30	(3a
Total floor area	(1a) + (1b) + (1c) + (1d).	(1n) = 98.16	(4)				
Dwelling volume				(3a) + (3b) + (3c)	+ (3d)(3n) =	304.30	(5)
2. Ventilation rate							
						m³ per hour	
Number of chimneys				0	x 40 =	0	(6a
Number of open flues				0	x 20 =	0	(6b
Number of intermittent fans				0	x 10 =	0	(7a
Number of passive vents				0	x 10 =	0	(7b
Number of flueless gas fires				0	x 40 =	0	(7c)
						Air changes pe hour	er
Infiltration due to chimneys, flues	s, fans, PSVs	(6a) + (6b) + (7a)	+ (7b) + (7c) =	0	÷ (5) =	0.00	(8)
If a pressurisation test has been co	carried out or is intended, p	proceed to (17), otherwise	continue from	(9) to (16)			
Air permeability value, q50, expre	essed in cubic metres per h	nour per square metre of e	envelope area			5.00	(17
If based on air permeability value	e, then (18) = [(17) ÷ 20] + (	8), otherwise (18) = (16)				0.25	(18
Air permeability value applies if a	pressurisation test has be	en done, or a design or sp	ecified air pern	neability is being u	sed		
Number of sides on which dwelling	ng is sheltered					3	(19
Shelter factor				1 - [	0.075 x (19)] =	0.78	(20
Adjusted infiltration rate					(18) x (20) =	0.19	(21
Infiltration rate modified for mon	ithly wind speed:						
Jan I	Feb Mar Apr	May Jun	Jul <i>A</i>	Aug Sep	Oct N	ov Dec	

Adjusted infiltration	(18) x (20) =		0.19	(21)									
Infiltration rate mo	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table 7													
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m -	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltration	n rate (allo	owing for sh	elter and v	vind speed	) = (21) × (2	2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	
										∑(22b)1	.12 =	2.62	(22b)

0.50

0.50

(23a)

(23b)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

If balanced with hea	t recovery: effici	iency in % allo	owing for in-use	factor (from T	able 4h) =					77.35	(23c)
a) If balanced mecha	nical ventilation	with heat re	covery (MVHR)	(22b)m + (23l	o) x [1 - (23c)	) ÷ 100] =					
(24a)m 0.	37 0.36	0.36	0.33 0.3	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air change rate	e - enter (24a) oi	r (24b) or (24	c) or (24d) in bo	x (25)							
(25)m 0.	37 0.36	0.36	0.33 0.3	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses and hea	t loss paramete	r									
The κ-value is the heat α	capacity per unit	area, see Ta	ble 1e.								
Elemen	t	Gross Area, m²	Openings, m <sup>2</sup>	Net area A, m²		alue, m²K	A x U, W/K	к-val kJ/m		Ахк, kJ/K	
Window*		Alea, III	""								(27)
				15.20	x 1.		21.51	N/		N/A	(27)
Doors External wall				2.10	x 2.		4.20	]		N/A	(26)
				85.93	-		25.78	N/		N/A	(29a)
Party Wall				69.44	-	00 =	0.00	N/	A	N/A	(32)
Total area of external el	_		l	103.23	(31)	(5/11-5) 10 0	41				
* for windows and roof		ive window C	i-vaiue is caicuic	itea using jorn	iuia 1/[(1/U\	7aiue)+0.04			2)	F4 40	7 (22)
Fabric heat loss, W/K =						()	,	6)(30) + (3	) =	51.49	(33)
Heat capacity Cm = ∑(A	•	•				(28)		+ (32a)(32		N/A	(34)
Thermal mass paramete							Calcula	ted separate	ely =	250.00	(35)
Thermal bridges: ∑(L x Ч										11.36	(36)
if details of thermal	oridging are not	known then	(36) = 0.15 x (31	)							7
Total fabric heat loss								(33) + (3	6) = [	62.84	(37)
Ventilation heat loss cal				24 20 24	20.07	20.27	24.00	22.26	24.72	26.40	7 (20)
` ,	.64 36.18	36.18	33.26 31.	31 30.34	29.37	29.37	31.80	33.26	34.72	36.18	(38)
Heat transfer coefficien	).48 99.02	99.02	96.10 94.	16 93.19	92.21	92.21	94.64	96.10	97.56	99.02	٦
(39)m 100	1.46 99.02	99.02	90.10   94.	10 95.19	92.21	•		<u>96.10                                    </u>		96.14	] ] (39)
Heat loss narameter (III	D) W/m²k /20	\m • (4)					Average –	<u> </u>	12 – [	90.14	] (39)
Heat loss parameter (HI (40)m 1.	02 1.01	1.01	0.98 0.9	0.95	0.94	0.94	0.96	0.98	0.99	1.01	7
(10)	32   1.01	1.01	0.50   0.5	0.55	1 0.5 1	!		Σ(40)112/:		0.98	] (40)
							, werage	<u>/</u> (10/112/		0.50	] (10)
4. Water heating ener	gy requirement										
									k۱	Wh/year	
Assumed occupancy, N								2.72	(42)		
If TFA > 13.9, N = 1 +	1.76 x [1 - exp(-	-0.000349 x (	TFA - 13.9) <sup>2</sup> )] + (	).0013 x (TFA -	13.9)						
If TFA $\leq$ 13.9, N = 1											
Annual average hot wat	er usage in litre	s per day Vd,	average = (25 x	N) + 36				98.84	(43)		
Annual average hot was	er usage has be	en reduced b	y 5% if the dwel	ling is designed	d to achieve	a water us	e target of	not more the	an 125 litr	es	
per person per day (all v	vater use, hot a	nd cold)									
	n Feb	Mar	Apr Ma	•	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litre					-			I I			٦
(44)m 108	3.73   104.77	100.82	96.87 92.	91 88.96	88.96	92.91	96.87	100.82	104.77	108.73	]
								∑(44)1:	12 =1	186.12	(44)
Energy content of hot w									4444	45652	٦
(45)m 161	1.63   141.36	145.87	127.17   122	.03   105.30	97.57	111.97	113.31	132.05	144.14	156.53	]
					(45) . (4	·		∑(45)1:	12 =1	.558.91	(45)
If instantaneous water l						01)					
For community heating		ion ioss whe	וובו טו ווטנ חטל V	vuter turik is pr	ESEIIL						
Distribution loss 0.15 x (46)m 24	.24 21.20	21.88	19.08 18.	30 15.79	14.64	16.80	17.00	19.81	21.62	23.48	(46)
(40)111 24	<u> </u>	21.00	19.00   18.	30   13./9	14.04	10.00	17.00	13.01	21.02	43.40	J (40)
								URN:	3 Charlott	te Street ve	ersion 1
										essor version	

95.13 (65)m 102.52 91.06 97.28 89.49 89.35 82.22 81.22 84.88 92.68 100.82 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains	s (see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (	Table 5), Wa	atts											
(66)m	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	(66)
Lighting gains (ca	lculated in A	Appendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	59.29	52.66	42.83	32.42	24.24	20.46	22.11	28.74	38.57	48.98	57.16	60.94	(67)
Appliances gains	(calculated	n Appendix	L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	378.09	382.01	372.12	351.08	324.51	299.54	282.85	278.93	288.82	309.86	336.43	361.40	(68)
Cooking gains (ca	lculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	(69)
Pumps and fans g	gains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evapo	ration (nega	ntive values	) (Table 5)										
(71)m	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	(71)
Water heating ga	ins (Table 5	)											
(72)m	137.79	135.50	130.75	124.29	120.10	114.19	109.17	115.60	117.89	124.57	132.13	135.51	(72)
		1	I.	I.	I	1	I.	I		I.	1	1	٠. ٦

#### 6. Solar gains

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

	4	Access facto Table 6d	or	Area m²	So	olar flux W/	_	Specific data or Table 6b		FF Specific dat or Table 6c	ta	Gains (W)	)
Southwest		0.77	×	4.80	x	37.39	x 0.9 x	0.63	х	0.70	=	54.85	(7
Northeast		0.77	x	6.24	x	11.51	x 0.9 x	0.63	x	0.70	=	21.95	(
Southeast		0.77	×	4.16	x	37.39	x 0.9 x	0.63	x	0.70	=	47.53	(
Solar gains in watt	s, calculate	ed for each i	month ∑(7	4)m(82)m	ı								
(83)m	124.33	219.44	309.04	412.68	481.53	500.96	486.17	432.28	352.10	254.60	150.44	105.34	(
Гotal gains - interr	al and sol	ar (73)m + (8	83)m										
(84)m	817.99	908.11	973.23	1038.95	1068.86	1053.64	1018.79	974.04	915.87	856.50	794.66	781.69	(
7.84													
7. Mean internal						0 = 1							٦,
Temperature durii			_									21.00	(
	Jan 	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Jtilisation factor f (86)m	0.99	0.98	, η1,m (see	0.90	0.76	0.56	0.37	0.39	0.66	0.90	0.98	0.99	٦ (
				1	0.70	0.50	0.57	0.39	0.00	0.50	0.36	0.99	\
Леап internal tem (87)m	20.33	20.44	20.60	20.77	20.90	20.95	20.95	20.95	20.93	20.80	20.52	20.35	٦ (
emperature durii							20.55	20.55	20.55	20.00	20.52	20.55	\
(88)m	20.07	20.08	20.08	20.10	20.12	20.13	20.14	20.14	20.11	20.10	20.09	20.08	٦ (
Jtilisation factor f				1									۱,
(89)m	0.99	0.97	0.94	0.87	0.70	0.49	0.29	0.31	0.59	0.87	0.97	0.99	٦ (
Nean internal tem	perature i	in the rest o	f dwelling <sup>-</sup>	Γ2 (follow s		in Table 9c						1	٠. ٦
(90)m	19.18	19.35	19.58	19.83	20.01	20.06	20.07	20.07	20.03	19.87	19.47	19.22	7 (
iving area fraction	า							fLA 25	9.20	÷ (4) =		0.30	_ ] (
Лean internal tem	perature 1	for the whol	e dwelling	fLA x T1 +(1	L - fLA) x T2	2				_			_
(92)m	19.52	19.67	19.88	20.11	20.27	20.32	20.33	20.33	20.30	20.15	19.79	19.55	(
apply adjustment	to the mea	an internal t	emperatur	e from Tab	le 4e, wher	re appropria	ate						
(93)m	19.37	19.52	19.73	19.96	20.12	20.17	20.18	20.18	20.15	20.00	19.64	19.40	(
8. Space heating					\			_				_	
at T: to the meson	Jan	Feb	Mar	Apr	May	Jun	Jul (03)m. an	Aug	Sep	Oct	Nov	Dec	- 0
et Ti to the mean Itilisation factor f			obtained a	it step 11 0	i Table 90,	SO that tim	= (93)III ali	iu recalculate	the ut	IIISALIOII IACLOI	ior gains	using rabie	29
(94)m	0.98	0.97	0.94	0.87	0.70	0.49	0.30	0.31	0.59	0.86	0.97	0.98	٦ (
Jseful gains, ŋmG							0.00			1 3.33		1 0.00	۱,
(95)m	804.44	881.20	912.99	901.90	751.73	514.94	302.45	302.40	541.58	740.38	769.77	769.58	٦ (
Nonthly average		mperature f											٠, ١
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	7 (
leat loss rate for i			ature, Lm, '		•	•	•	· ·				•	_ `
(97)m	1494.22	1438.29	1280.69	1081.97	793.08	519.08	302.61	302.60	553.80	883.84	1232.72	1436.21	(
pace heating req	uirement f	or each mor	nth, kWh/n	nonth = 0.0	24 x [(97)n	n - (95)m] x	(41)m						_
(98)m	513.20	374.36	273.56	129.65	30.77	0.00	0.00	0.00	0.00	106.74	333.32	495.97	]
				•			Total per y	ear (kWh/ye	ar) = ∑(	98)15, 101	12 = 7	2257.58	_ ] (

9a. Energy Requ	uirements - I	Individual h	neating syst	tems includ	ling micro-	СНР							
Space heating:													
Fraction of space	heating fro	m secondai	y/supplem	entary syst	em (Table :	11)			0.00	(201)			
Fraction of space	heating fro	m main sys	tem(s) 1-	(201)					1.00	(202)			
Fraction of main	heating from	n main syst	em 2						0.00	(203)			
Fraction of total	space heat f	rom main s	ystem 1 (2	02) x [1 - (2	03)]				1.00	(204)			
Fraction of total									0.00	(205)			
Efficiency of main				- , (,					90.60	(206)			
(from database o				propriate by	the amou	nt shown in	the 'space				Table 4c)		
g.o aatazaee e	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating re	quirement, l	kWh/month	n (as calcula	ited above)	•								
(98)m	513.20	374.36	273.56	129.65	30.77	0.00	0.00	0.00	0.00	106.74	333.32	495.97	
Space heating fu	el (main hea	iting system	1), kWh/m	nonth = (98	)m x (204) :	x 100 ÷ (206	5)						
(211)m	566.45	413.21	301.95	143.10	33.96	0.00	0.00	0.00	0.00	117.81	367.91	547.43	
						Т	otal per y	ear (kWh/y	ear) = ∑(2:	11)15, 10	.12 = 2	2491.81	(211)
Water heating:													
Output from wat	er heater, k	Wh/month	(calculated	d above)									
(64)m	222.60	196.43	206.84	186.18	183.00	164.30	158.55	172.94	172.31	193.02	203.14	217.50	
										∑(64)1	.12 = 2	2276.81	(64)
Efficiency of wate	er heater pe	r month											
(217)m	87.07	86.61	85.66	83.97	81.28	79.90	79.90	79.90	79.90	83.41	86.23	87.05	
Fuel for water he	eating, kWh/	/month = (6	4)m x 100 ÷	÷ (217)m									
(219)m	255.65	226.80	241.47	221.72	225.14	205.64	198.43	216.45	215.66	231.42	235.59	249.86	
							Tota	al per year (	kWh/year	) = ∑(219)1	.12 = 2	2723.81	(219)
Annual Totals Su	ımmary:									kWh/ye	ear k\	Wh/year	
Space heating fu	el used, ma	in system 1									2	2491.81	(211)
Water heating fu	uel used										2	2723.81	(219)
Electricity for pu	mps, fans aı	nd electric	keep-hot (T	able 4f):									
mechanical ve	entilation fai	ns - balance	ed, extract o	or positive i	nput from	outside				185.6	2		(230a)
warm air hea										0.00			(230b
central heatin										130.0	0		(230c)
oil boiler pum	пр									0.00			(230d
boiler flue far	ı									45.00	)		(230e
maintaining e			for gas con	nbi boiler						0.00			(230f)
pump for sola		7								0.00		0.00.00	(230g)
Total electricity f	or the above	е								∑(230a)(2	:30g) [	360.62	(231)
el	,											440.00	7 (22-)
Electricity for lig	nting (calcul	lated in App	pendix L):									418.84	(232)
10a. Fuel costs	- Indiv <u>idual</u>	heating sys	tems <u>inclu</u>	ding micro-	СНР								
						kWh/vear		Fı	uel price		Fuel	cost £/vea	r

10a. Fuel costs - Individual heating systems including mic	ro-CHP					
	Fuel kWh/year		Fuel price (Table 12)		Fuel cost £/yea	r
Space heating - main system 1	2491.81	Х	3.10	x 0.01 =	77.25	(240)
Water heating cost (other fuel)	2723.81	х	3.10	x 0.01 =	84.44	(247)
Pumps, fans and electric keep-hot	360.62	х	11.46	x 0.01 =	41.33	(249)
Energy for lighting	418.84	х	11.46	x 0.01 =	48.00	(250)
Additional standing charges (Table 12)					106.00	(251)
Total energy cost			(240)(242	) + (245)(254)	357.01	(255)

11a. SAP rating - Individual heating systems including micro-CHP			
Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.17	(257)
SAP value		83.65	
SAP rating		84	(258)
SAP band		В	

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	2491.81	x	0.198	=	493.38	(261)
Water heating	2723.81	x	0.198	=	539.32	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1032.69	(265)
Pumps, fans and electric keep-hot	360.62	x	0.517	=	186.44	(267)
Lighting	418.84	x	0.517	=	216.54	(268)
Total carbon dioxide emissions				∑(261)(271) =	1435.67	(272)
Dwelling carbon dioxide emissions rate				(272) ÷ (4) =	14.63	(273)
El value					86.56	
El rating (see section 14)					87	(274)
EI band					В	

	Energy kWh/year		Primary Energy Factor		Primary Energy	
Space heating - main system 1	2491.81	х	1.02	=	2541.64	(261*)
Water heating	2723.81	х	1.02	=	2778.29	(264*)
Space and water heating			(261*) + (262*) + (2	263*) + (264*) =	5319.93	(265*)
Pumps, fans and electric keep-hot	360.62	x	2.92	=	1053.01	(267*)
Lighting	418.84	х	2.92	=	1223.00	(268*)
Total primary energy kWh/year			Σ(:	261*)(271*) =	7595.95	(272*)
Primary energy kWh/m2/year				(272*) ÷ (4) =	77.38	(273*)

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	3 Charlotte Street, London, W1T 4QH		

Check	Evidence		Produced by	OK?
Criterion 1: predicted carbon did	oxide emission fro	om proposed dwelling does not exceed the target		
TER (kg CO₂/m².a)	Fuel = Mains 8	gas	Authorised SAP Assessor	
	Fuel factor = 1	1.00		
	TER = 16.29			
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 12.16		Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to that target?	DER 12.16 < T	ER 16.29	Authorised SAP Assessor	Passed
Criterion 2: the performance of	the building fabri	c and the heating, hot water and fixed lighting syste	ms should be no worse than the design	limits
Fabric U-values				
Are all U-values better than the	Element	Weighted average Highest	Authorised SAP Assessor	Passe
design limits in Table 2?	Wall	0.20 (max 0.30) 0.20 (max 0.70)		
	Party wall	0.00 (max 0.20) N/A		
	Floor	(no floor)		
	Roof	(no roof)		
	Openings	1.56 (max 2.00) 2.00 (max 3.30)		
Thermal bridging				
How has the loss from thermal bridges been calculated?	Thermal bridg	ing calculated using default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems				
Does the efficiency of the heatir	ng Main heating	system:	Authorised SAP Assessor	Passe
systems meet the minimum valu	ue Mains gas, Re	gular boiler from database		
set out in the Domestic Heating		max 24/2 HE Plus		
Compliance Guide?		9.60% - SEDBUK 2009		
	Minimum = 88	3.00%		
	Secondary hea	ating system: None		
Does the insulation of the hot		ne = 180.00 litres	Authorised SAP Assessor	Passe
water cylinder meet the standar	ds Nominal cylin	der loss = 1.82kWh/day		
set out in the Domestic Heating	Maximum per	mitted cylinder loss = 2.10kWh/day		
Compliance Guide?	Primary hot w	rater pipes are insulated		
Do controls meet the minimum	Space heating	control:	Authorised SAP Assessor	Passe
controls provision set out in the Domestic Heating Compliance	-	perature zone control		
Guide?	Hot water cor	ntrol:		
		k (main system 1)		
	Cylinder therr			
	Separate water	er control		

Check	Evidence	Produced by	ОК?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appro	priate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of the	e dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.2W/m <sup>2</sup> • Part Wall (0.00) Use of the following low carbon or renewable technologie • Photovoltaic array		

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

#### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	3 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimension	S							
			Area (m²)		Average store height (m)	у	Volume (m³	)
owest occupied			98.16	(1a) x	3.10	(2a) =	304.30	(
otal floor area	(1a) + (1b) + (1	c) + (1d)(1n) =	98.16	(4)				
Owelling volume					(3a) + (3b) + (	3c) + (3d)(3n) =	304.30	(!
2. Ventilation rate								
2. Ventilation rate							m³ per hou	r
Number of chimneys					0	x 40 =	0	(
lumber of open flues					0	x 20 =	0	(
lumber of intermittent fans					0	x 10 =	0	(
lumber of passive vents					0	x 10 =	0	(
lumber of flueless gas fires					0	x 40 =	0	(
							Air changes p hour	er
nfiltration due to chimneys, flu	es, fans, PSVs		(6a) + (6b) + (7	7a) + (7b) + (7d	:) = 0	÷ (5) =	0.00	(
a pressurisation test has beer	carried out or is int	ended, proceed t	o (17), otherwi	ise continue fro	om (9) to (16)			
ir permeability value, q50, exp	ressed in cubic met	res per hour per	square metre	of envelope are	ea		5.00	(
based on air permeability val	ue, then (18) = [(17)	÷ 20] + (8), other	rwise (18) = (16	5)			0.25	(
ir permeability value applies ij	a pressurisation tes	st has been done,	or a design or	specified air p	ermeability is being	g used		
lumber of sides on which dwe	ling is sheltered						3	(:
helter factor					1	- [0.075 x (19)] =	0.78	(:
djusted infiltration rate						(18) x (20) =	0.19	(:
nfiltration rate modified for mo	onthly wind speed:							
Jan	Feb Mar	Apr Ma	av Jun	Jul	Aug Sep	Oct No	ov Dec	

										(/ (-	,		
Infiltration rate m	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind speed	from Table	7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	]
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	]
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltration	on rate (allo	owing for sh	elter and v	vind speed	) = (21) × (2	.2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	]
										∑(22b)1	.12 =	2.62	(22b)

0.50

0.50

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

(23a)

(23b)

If balanced w	th heat reco	very: effici	ency in % al	lowing for	in-use fact	tor (from Ta	ble 4h) =					77.35	(23c)
a) If balanced	mechanical	ventilation	with heat r	ecovery (N	ЛVHR) (22	2b)m + (23b	) x [1 - (2	3c) ÷ 100] =					
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air chan	ge rate - ent	ter (24a) or	(24b) or (2	4c) or (24d	) in box (2	5)							
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses a	nd heat loss	paramete	r										
The κ-value is the	heat capac	ity per unit	area, see T	able 1e.									
E	lement		Gross	•	nings,	Net area		-value,	A x U,	K-Va	•	Αхκ,	
I *			Area, m <sup>2</sup>	п	n²	A, m <sup>2</sup>		V/m²K	W/K		n².K	kJ/K	7 (27)
Window*						15.20	1 –	1.42 =			/A	N/A	(27)
Doors						2.10	1 =	2.00 =			/A	N/A	」(26) □ (20 )
External wall						85.93	] x [_	0.20 =			/A	N/A	(29a)
Party Wall		. = 4 2				69.44	X	0.00 =	0.00	N,	/A	N/A	(32)
Total area of exte						103.23	(31)	(11) (-1) - 1 - 0	0.41	-1-22			
* for windows an	-		ve winaow	U-value is (	caicuiatea	using Jormi	ла 1/ <u>[</u> (1/	Ovalue)+0.					٦ (۵۵)
Fabric heat loss,		U)						(2.2)	•	26)(30) + (3		42.90	∫ (33)
Heat capacity Cm								(28).		+ (32a)(32		N/A	∫ (34)
Thermal mass pa									Calcula	ted separat	ely = [	250.00	(35)
Thermal bridges:					- (0.1)							15.48	(36)
if details of th		ng are not	known ther	1(36) = 0.1	5 x (31)								7
Total fabric heat										(33) + (3	36) = [	58.38	(37)
Ventilation heat					24.24	20.24	20.27	20.27	24.00	22.26	24.72	26.40	7 (20)
(38)m	37.64	36.18	36.18	33.26	31.31	30.34	29.37	29.37	31.80	33.26	34.72	36.18	(38)
Heat transfer coe (39)m	96.02	94.56	(38)m 94.56	91.64	89.69	88.72	87.75	87.75	90.18	91.64	93.10	94.56	٦
(39)111	90.02	34.30	94.30	91.04	09.09	88.72	87.73	87.73	_	Σ(39)112/		91.68	」 ີ (39)
Heat loss params	+or/UID) \A	1/m²V (20)	m : (4)						Average -	2(33)112/	12	91.00	] (33)
Heat loss parame (40)m	0.98	0.96	0.96	0.93	0.91	0.90	0.89	0.89	0.92	0.93	0.95	0.96	7
(10)	0.50	0.50	0.50	0.55	0.52	0.50	0.00	1 0.00		Σ(40)112/		0.93	(40)
									71101460	Z( 10/112)		0.50	
4. Water heatin	g energy red	quirement											
											k'	Wh/year	
Assumed occupa	ncy, N									2.72	(42	)	
If TFA > 13.9,	N = 1 + 1.76	x [1 - exp(-	0.000349 x	(TFA - 13.9	) <sup>2</sup> )] + 0.00	13 x (TFA - 1	L3.9)						
If TFA $\leq$ 13.9,	N = 1												
Annual average h	ot water us	age in litres	per day Vo	l,average =	(25 x N) +	36				98.84	(43	)	
Annual average I	not water us	age has be	en reduced	by 5% if th	e dwelling	is designed	to achie	ve a water u	se target of	not more th	an 125 liti	res	
per person per do	ay (all water	use, hot ar	nd cold)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage					1					1	_		7
(44)m	108.73	104.77	100.82	96.87	92.91	88.96	88.96	92.91	96.87	100.82	104.77	108.73	]
										∑(44)1	12 =	1186.12	(44)
Energy content o				-							44444	456.52	٦
(45)m	161.63	141.36	145.87	127.17	122.03	105.30	97.57	111.97	113.31	132.05	144.14	156.53	] (45)
If inctantes	uator best	a at nated	of was 1= 1	ot weter :	toronal -	ntor 0 :- !-	00/101	1611		∑(45)1	17 = [	1558.91	(45)
If instantaneous  For community h		-						0 (01)					
	_		.J. IUJJ WIII	carer or 110	wate	, cann is pre	Jene						
Distribution loss (46)m	24.24	21.20	21.88	19.08	18.30	15.79	14.64	16.80	17.00	19.81	21.62	23.48	(46)
\ · = /···				20.00				1 20.00					_ ( .0/
												StreetPV ve	
										NHF	R Plan Ass	essor version	n 5 4 1

95.13 (65)m 102.52 91.06 97.28 89.49 89.35 82.22 81.22 84.88 92.68 100.82 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains	(see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (	Table 5), Wa	atts											
(66)m	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	(60
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	59.29	52.66	42.83	32.42	24.24	20.46	22.11	28.74	38.57	48.98	57.16	60.94	(67
Appliances gains	(calculated i	n Appendix	L, equation	n L13 or L1	3a), also se	e Table 5							
(68)m	378.09	382.01	372.12	351.08	324.51	299.54	282.85	278.93	288.82	309.86	336.43	361.40	(68
Cooking gains (ca	Iculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	(69
Pumps and fans g	gains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70
Losses e.g. evapo	ration (nega	itive values	) (Table 5)										
(71)m	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	(71
Water heating gains (Table 5)													
(72)m	137.79	135.50	130.75	124.29	120.10	114.19	109.17	115.60	117.89	124.57	132.13	135.51	(72
		•		•		•	•	•		•	•	•	_

#### 6. Solar gains

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

		Access factor Table 6d	or	Area m²	So	olar flux W/	m² g	Specific dat or Table 6b		FF Specific da or Table 60		Gains (W)	)
Southwest		0.77	x	4.80	x	37.39	x 0.9 x	0.63	х	0.70	=	54.85	(;
Northeast		0.77	x	6.24	] x	11.51	x 0.9 x	0.63	x	0.70	=	21.95	(
Southeast		0.77	x	4.16	] x	37.39	x 0.9 x	0.63	x	0.70	=	47.53	] (
Solar gains in wa	tts, calculat	ted for each	month ∑(7	4)m(82)m	1								
(83)m	124.33	219.44	309.04	412.68	481.53	500.96	486.17	432.28	352.10	254.60	150.44	105.34	] (
Total gains - inte	rnal and sol	lar (73)m + (8	83)m										_
(84)m	817.99	908.11	973.23	1038.95	1068.86	1053.64	1018.79	974.04	915.87	856.50	794.66	781.69	] (
7. Mean interna	al temperat	ture (heating	g season)										
Temperature dui				rea from Ta	ble 9, Th1('	°C)						21.00	7 (
•	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	٠.
Utilisation factor	for gains fo	or living area	, η1,m (see	e Table 9a)									
(86)m	0.99	0.98	0.95	0.89	0.73	0.53	0.35	0.37	0.64	0.89	0.98	0.99	
Mean internal te	mp of living	g area T1 (ste	eps 3 to 7 i	n Table 9c)									_
(87)m	20.38	20.49	20.64	20.80	20.92	20.95	20.96	20.96	20.94	20.83	20.56	20.40	
Temperature dui	ring heating	g periods in t	he living a	rea from Ta	ble 9, Th2('	°C)							_
(88)m	20.10	20.12	20.12	20.14	20.16	20.17	20.17	20.17	20.15	20.14	20.13	20.12	
Jtilisation factor			elling η2,m										_
(89)m	0.99	0.97	0.94	0.86	0.68	0.47	0.28	0.29	0.57	0.86	0.97	0.99	(
Mean internal te	_							T T		1	_	T	7
(90)m	19.28	19.45	19.67	19.90	20.06	20.10	20.11	20.11	20.08	19.94	19.57	19.32	] ( -
iving area fracti								fLA	29.20	÷ (4) =		0.30	_] (
Mean internal te	_	<u> </u>					20.20	20.20	20.24	20.20	10.00	10.64	٦,
(92)m	19.61	19.76	19.96	20.17	20.31	20.35	20.36	20.36	20.34	20.20	19.86	19.64	_] (
Apply adjustmen (93)m	19.46	19.61	19.81	20.02	20.16	20.20	20.21	20.21	20.19	20.05	19.71	19.49	٦,
(93)111	13.40	19.01	15.61	20.02	20.10	20.20	20.21	20.21	20.13	20.03	19.71	15.45	(
8. Space heating	g requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Set Ti to the mea	n internal t	emperature	obtained a	at step 11 o	f Table 9b,	so that tim	= (93)m a	nd recalculat	te the uti	ilisation facto	r for gains	using Table	e 9
Jtilisation factor	for gains, r	ηm					_						_
(94)m	0.98	0.97	0.93	0.86	0.68	0.47	0.29	0.30	0.57	0.85	0.97	0.98	_] (
Jseful gains, ηm					1	1	ı				·		7
(95)m	803.70	879.23	907.80	889.03	728.88	494.33	290.46	290.43	522.26	729.72	767.86	768.91	_] (
Monthly average		<del>- '</del>			I	1		1		1		1	٦.
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	_] (
Heat loss rate for		<del></del>		1	750:5	400	200 ==	1 200 == 1	F00 = -	0	4400 = -	140=6 55	٦.
(97)m	1436.31		1230.24	1037.50	759.19	496.98	290.55	290.55	530.72	847.96	1183.66	1379.69	_] (
Space heating re		1	i	1		1			2.22	07.07	200.0=	454.50	٦
(98)m	470.66	337.61	239.89	106.89	22.55	0.00	0.00	0.00	0.00	87.97	299.37	454.42	]
							Total per	year (kWh/y	ear) = ∑(	98)15, 10		2019.37	] (
pace heating re	quirement i	in kWh/m²/y	/ear							(98)	÷ (4)	20.57	

9a. Energy Requirements - Individual heating systems including	g micro-CHP			
Space heating:				
Fraction of space heating from secondary/supplementary system	ı (Tahle 11)	0.00	(201)	
Fraction of space heating from main system(s) 1 - (201)	· (Table 11)	1.00	(202)	
			=	
Fraction of main heating from main system 2		0.00	(203)	
Fraction of total space heat from main system 1 (202) x [1 - (203	5)]	1.00	(204)	
Fraction of total space heat from main system 2 (202) x (203)		0.00	(205)	
Efficiency of main space heating system 1 (%)		90.60	(206)	
(from database or Table 4a/4b, adjusted where appropriate by th			nt' column of Table 4	4c)
Jan Feb Mar Apr	May Jun Ju	ıl Aug Sep	Oct Nov	, Dec
Space heating requirement, kWh/month (as calculated above)				
` '	22.55 0.00 0.0	0.00 0.00	87.97 299.3	37   454.42
Space heating fuel (main heating system 1), kWh/month = (98)m				
(211)m 519.49 372.63 264.78 117.98	24.89 0.00 0.0		97.10   330.4	
	Total p	per year (kWh/year) = $\sum (2$	11)15, 1012 =	2228.88 (211)
Water heating:				
Output from water heater, kWh/month (calculated above)				
(64)m 222.60 196.43 206.84 186.18 1	183.00   164.30   158	.55 172.94 172.31	193.02 203.1	14 217.50
			∑(64)112 =	2276.81 (64)
Efficiency of water heater per month				
(217)m 86.86 86.35 85.31 83.50	80.95 79.90 79.	90 79.90 79.90	82.97 85.9	5 86.84
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m				
(219)m 256.26 227.49 242.46 222.98 2	226.07   205.64   198	.43 216.45 215.66	232.64 236.3	36 250.47
		Total per year (kWh/year	·) = ∑(219)112 = [	2730.89 (219)
Annual Totals Summary:			kWh/year	kWh/year
Annual Totals Summary: Space heating fuel used, main system 1			kWh/year	kWh/year 2228.88 (211)
·			kWh/year	
Space heating fuel used, main system 1			kWh/year	2228.88 (211)
Space heating fuel used, main system 1 Water heating fuel used	ut from outside		kWh/year	2228.88 (211) 2730.89 (219)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot (Table 4f):	ut from outside			2228.88 (211) 2730.89 (219) (230a)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump	ut from outside		185.62	2228.88 (211) 2730.89 (219) (230a) (230b) (230c)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans  central heating pump  oil boiler pump	ut from outside		185.62 0.00 130.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan	ut from outside		185.62 0.00 130.00 0.00 45.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d) (230e)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler	ut from outside		185.62 0.00 130.00 0.00 45.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230c) (230e) (230e) (230f)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating	ut from outside		185.62 0.00 130.00 0.00 45.00 0.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d) (230e) (230f) (230g)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler	ut from outside		185.62 0.00 130.00 0.00 45.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d) (230e) (230f)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above	ut from outside		185.62 0.00 130.00 0.00 45.00 0.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):			185.62 0.00 130.00 0.00 45.00 0.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d) (230e) (230f) (230g)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and O			185.62 0.00 130.00 0.00 45.00 0.00 0.00	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):			185.62 0.00 130.00 0.00 45.00 0.00 0.00	2228.88 (211) 2730.89 (219) (230a) (230b) (230c) (230d) (230e) (230f) (230g) 360.62 (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Q Electricity generated by PVs (Appendix M) (negative quantity)	<b>1</b> ):		185.62 0.00 130.00 0.00 45.00 0.00 0.00	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and O	<b>1</b> ):	Fuel price (Table 12)	185.62 0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(230g)	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-CH	IP Fuel kWh/year	(Table 12)	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g)	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) 360.62 (231)  418.84 (232)  -657.28 (233)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and O Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-CH  Space heating - main system 1	(1): Fuel kWh/year  2228.88	(Table 12) x 3.10	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g)	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)  418.84 (232)  -657.28 (233)  uel cost f/year  69.10 (240)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and O Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-CH  Space heating - main system 1  Water heating cost (other fuel)	2):  Fuel kWh/year  2228.88  2730.89	x 3.10 x 3.10	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g)	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)  418.84 (232)  -657.28 (233)  uel cost £/year  69.10 (240) 84.66 (247)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Q Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-CH  Space heating - main system 1  Water heating cost (other fuel)  Pumps, fans and electric keep-hot	2):  Fuel kWh/year  2228.88  2730.89  360.62	x 3.10 x 3.10 x 11.46	185.62 0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(230g) Fill x 0.01 = x 0.	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)  418.84 (232)  -657.28 (233)  uel cost £/year  69.10 (240) 84.66 (247) 41.33 (249)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive inp warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and O Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-CH  Space heating - main system 1  Water heating cost (other fuel)	2):  Fuel kWh/year  2228.88  2730.89	x 3.10 x 3.10	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g)	2228.88 (211) 2730.89 (219)  (230a) (230b) (230c) (230d) (230e) (230g) (230g) 360.62 (231)  418.84 (232)  -657.28 (233)  uel cost £/year  69.10 (240) 84.66 (247)

PV savings (negative quantity)	-657.28	Х	11.46 x 0.	.01 =	-75.32	(252)
Total energy cost			(240)(242) + (245	)(254)	273.75	(255)
11a. SAP rating - Individual heating systems including mid	cro-CHP					
Energy cost deflator (Table 12)					0.47	(256)
Energy cost factor (ECF)			[(255) x (256)] ÷ [(4) +	45.0] =	0.90	(257)
SAP value					87.46	
SAP rating					87	(258)
SAP band					В	
12a. Carbon dioxide emissions - Individual heating system	ns including micro-CHP					
	Energy kWh/year		Emissions Factor		Emissions (gCO2/year)	
Space heating - main system 1	2228.88	х	0.198	=	441.32	(261)
Water heating	2730.89	х	0.198	=	540.72	(264)
Space and water heating			(261) + (262) + (263) +	(264) =	982.04	(265)
Pumps, fans and electric keep-hot	360.62	х	0.517	=	186.44	(267)
Lighting	418.84	x	0.517	=	216.54	(268)
Energy saving/generation technologies:						
PV emission savings (negative quantity)	-657.28	х	0.529	=	-347.70	(269)
Total carbon dioxide emissions			∑(261)	.(271) =	1037.31	(272)
Dwelling carbon dioxide emissions rate			(272	(4) =	10.57	(273)
El value					90.29	
El rating (see section 14)					90	(274)
El band					В	
13a. Primary energy - Individual heating systems includin	ng micro-CHP					
	Energy kWh/year		Primary Energy Factor	Pri	imary Energy	y
Space heating - main system 1	2228.88	x	1.02	=	2273.46	(261*
Water heating	2730.89	х	1.02	=	2785.51	(264)
Space and water heating			(261*) + (262*) + (263*) + (	264*) =	5058.97	(265
Pumps, fans and electric keep-hot	360.62	Х	2.92	=	1053.01	(267)
Lighting	418.84	Х	2.92	=	1223.00	(268
Energy saving/generation technologies:						
PV primary energy savings (negative quantity)	-657.28	х	2.92	=	-1919.26	(269*
Total primary energy kWh/year			∑(261*)(	271*) =	5415.73	(272*

55.17

(272\*) ÷ (4) = [

Primary energy kWh/m2/year

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	4 Charlotte Street, London, W1T 4QH		

Check	Evidence			Produced by	OK?
Criterion 1: predicted carbon dioxi	de emission fr	om proposed dwellin	g does not exceed the target		
TER (kg CO₂/m².a)	Fuel = Mains g Fuel factor = 1 TER = 16.29	•		Authorised SAP Assessor	
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 16.27			Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 16.27 < T	ER 16.29		Authorised SAP Assessor	Passe
Criterion 2: the performance of the	e building fabr	ic and the heating, ho	ot water and fixed lighting systen	ns should be no worse than the design	n limits
Fabric U-values					
Are all U-values better than the design limits in Table 2?	Element Wall Party wall Floor Roof Openings	Weighted average 0.30 (max 0.30) 0.00 (max 0.20) (no floor) (no roof) 1.57 (max 2.00)	e Highest 0.30 (max 0.70) N/A 2.00 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging					
How has the loss from thermal bridges been calculated?	Thermal bridg reference: Te		user-specified y-value of 0.1, wit	h Authorised SAP Assessor	
Heating and hot water systems					
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Mains gas, Re Potterton Pro Efficiency = 89 Minimum = 8	gular boiler from data max 24/2 HE Plus 9.60% - SEDBUK 2009 8.00%		Authorised SAP Assessor	Passed
Does the insulation of the hot		ating system: None me = 180.00 litres		Authorised SAP Assessor	Passe
water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Nominal cylin Maximum per		= 2.10kWh/day		. 35561
Oo controls meet the minimum controls provision set out in the Domestic Heating Compliance		perature zone contro	ol	Authorised SAP Assessor	Passe
Guide?	Hot water cor Boiler interloo Cylinder them	ck (main system 1)			

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comp with paragraphs 42 to 44?	oly Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has app	ropriate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of t	he dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettere in practice?	The following walls/wall have a U-value less than 0.2W/m²K: d) • Part Wall (0.00)	Authorised SAP Assessor	

#### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	4 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimension	ns	Area (m²)		Average storey height (m)		Volume (m³)	
Lowest occupied		98.16 (1a)	x	3.10	(2a) =	304.30	(3
Total floor area	(1a) + (1b) + (1c) + (1d)(1	n) = 98.16 (4)					
Owelling volume				(3a) + (3b) + (3c	c) + (3d)(3n) =	304.30	(5
2. Ventilation rate							
						m³ per hour	
lumber of chimneys				0	x 40 =	0	(6
lumber of open flues				0	x 20 =	0	(6
lumber of intermittent fans				0	x 10 =	0	(7
lumber of passive vents				0	x 10 =	0	(7
lumber of flueless gas fires				0	x 40 =	0	(7
						Air changes pe	er
nfiltration due to chimneys, fl	ues, fans, PSVs	(6a) + (6b) + (7a) + (7	b) + (7c) =	0	÷ (5) =	0.00	(8
a pressurisation test has bee	n carried out or is intended, proc	eed to (17), otherwise cont	inue from	(9) to (16)			
ir permeability value, q50, ex	pressed in cubic metres per hour	per square metre of envel	ope area			5.00	(1
based on air permeability va	lue, then (18) = [(17) ÷ 20] + (8), (	otherwise (18) = (16)				0.25	(1
ir permeability value applies i	if a pressurisation test has been a	lone, or a design or specifie	d air pern	neability is being ເ	ısed		
lumber of sides on which dwe	elling is sheltered					3	(1
helter factor				1 -	[0.075 x (19)] =	0.78	(2
djusted infiltration rate					(18) x (20) =	0.19	(2
nfiltration rate modified for m	onthly wind speed:						
Jan	Feb Mar Apr	May Jun Ju	ıl A	lug Sep	Oct N	ov Dec	

Infiltration rate me	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind speed	from Table	. 7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	]
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m -	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	]
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltration	on rate (allo	owing for sh	elter and v	vind speed	) = (21) × (2	2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	]
										∑(22b)1	.12 =	2.62	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

If balanced w	ith heat reco	very: effici	ency in % a	lowing for	in-use fact	tor (from Ta	ble 4h) =					77.35	(23c)
a) If balanced	mechanical	ventilation	with heat i	ecovery (N	ЛVHR) (22	2b)m + (23b	) x [1 - (2	3c) ÷ 100] =					
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air char	nge rate - ent	ter (24a) or	(24b) or (2	4c) or (24d	) in box (2	5)							
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses a	nd heat loss	paramete	r										
The κ-value is the	e heat capac	ity per unit	area, see T	able 1e.									
E	lement		Gross	•	nings,	Net area		value,	A x U,	K-va	-	Αхκ,	
			Area, m <sup>2</sup>	п	n²	A, m <sup>2</sup>		//m²K	W/K		n².K	kJ/K	7 (0-1)
Window*						13.10	1 -	1.42 =	18.54		/A	N/A	<u>  (27)</u>
Doors						2.10		2.00 =	4.20		/A	N/A	] (26)
External wall						88.03		0.30 =	26.41		/A	N/A	(29a)
Party Wall		2				69.44	1	0.00 =	0.00	N	/A	N/A	(32)
Total area of exte		_				103.23	(31)						
* for windows an	-		ve window	U-value is i	calculated	using formi	ıla 1/[(1/	UValue)+0.0					7
Fabric heat loss,		U)							•	26)(30) + (3		49.15	<u>(33)</u>
Heat capacity Cm								(28).		+ (32a)(32		N/A	<u> </u> (34)
Thermal mass pa									Calcula	ited separat	ely =	250.00	<b>(35)</b>
Thermal bridges:												10.32	(36)
if details of th	_	ing are not	known thei	n (36) = 0.1	5 x (31)								7
Total fabric heat										(33) + (3	36) =	59.47	(37)
Ventilation heat									24.00		0.1-0	00.10	٦ (۵۵)
(38)m	37.64	36.18	36.18	33.26	31.31	30.34	29.37	29.37	31.80	33.26	34.72	36.18	(38)
Heat transfer coe (39)m	97.11	95.65	95.65	92.73	90.78	89.81	88.84	88.84	91.27	92.73	94.19	95.65	٦
(39)111	97.11	95.05	95.05	92.73	30.78	85.81	00.04	00.04		Σ(39)112/		92.77	」 ີ (39)
Heat loss parame	stor (ULD) \A	1/m²V (20)	m : (4)						Average -	2(39)112/	12	32.77	] (33)
Heat loss parame (40)m	0.99	0.97	0.97	0.94	0.92	0.91	0.91	0.91	0.93	0.94	0.96	0.97	7
(10)	0.55	0.57	0.57	0.5 .	0.52	0.01	0.51	0.52		Σ(40)112/		0.95	(40)
									7.100.000	2(10)112)		0.55	
4. Water heating	g energy red	quirement											
											k	Wh/year	
Assumed occupa	ncy, N									2.72	(42	)	
If TFA > 13.9,	N = 1 + 1.76	x [1 - exp(-	0.000349 x	(TFA - 13.9	) <sup>2</sup> )] + 0.00	13 x (TFA - 1	13.9)						
If TFA $\leq$ 13.9,	N = 1												
Annual average h	not water us	age in litres	per day Vo	l,average =	(25 x N) +	36				98.84	(43	)	
Annual average l	hot water us	age has be	en reduced	by 5% if th	e dwelling	is designed	to achiev	e a water u	se target of	not more th	an 125 liti	res	
per person per de	ay (all water	use, hot ar	nd cold)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage					1	1			1				7
(44)m	108.73	104.77	100.82	96.87	92.91	88.96	88.96	92.91	96.87	100.82	104.77	108.73	]
_										∑(44)1	.12 =	1186.12	(44)
Energy content o				-		_					14414	150.52	٦
(45)m	161.63	141.36	145.87	127.17	122.03	105.30	97.57	111.97	113.31	132.05	144.14	156.53	] (45)
16 :			- f / /	-44		t0' b	(46) +-	(64)		∑(45)1	.12 =	1558.91	(45)
If instantaneous For community h		-						(01)					
			.J. 1033 WIII	carer or 110	wate	. cann is pre	Jene						
Distribution loss (46)m	24.24	21.20	21.88	19.08	18.30	15.79	14.64	16.80	17.00	19.81	21.62	23.48	(46)
· · •/···				20.00				1 20.00		1 -5.51			_ ( .0/
												te Street ve	
										NHF	R Plan Ass	essor version	n 5 / 1

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains	(see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (1	Table 5), Wa	atts											
(66)m	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	(66
Lighting gains (cal	culated in A	ppendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	61.21	54.37	44.21	33.47	25.02	21.12	22.82	29.67	39.82	50.56	59.01	62.91	(67)
Appliances gains (	calculated i	n Appendix	L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	378.09	382.01	372.12	351.08	324.51	299.54	282.85	278.93	288.82	309.86	336.43	361.40	(68)
Cooking gains (cal	culated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	(69)
Pumps and fans g	ains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evapor	ration (nega	itive values	) (Table 5)										
(71)m	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	(71)
Water heating gai	ns (Table 5)	)											
(72)m	137.79	135.50	130.75	124.29	120.10	114.19	109.17	115.60	117.89	124.57	132.13	135.51	(72)
													_

#### 6. Solar gains

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

	A	ccess facto Table 6d	or	Area m²	So	olar flux W/	m² į	g Specific dat or Table 6b	a	FF Specific da or Table 60		Gains (W)	)
Southwest		0.77	×	2.70	x	37.39	x 0.9 x	0.63	х	0.70	=	30.85	(7
Northeast		0.77	×	6.24	x	11.51	x 0.9 x	0.63	x	0.70	=	21.95	(
Southeast		0.77	×	4.16	x	37.39	x 0.9 x	0.63	х	0.70	=	47.53	(
Solar gains in watts, c	alculate	d for each i	month ∑(7	4)m(82)m	ı								
(83)m 1	00.33	178.54	254.99	346.26	408.80	427.13	413.78	364.67	292.48	208.15	121.68	84.83	(
Гotal gains - internal a	and sola	r (73)m + (8	83)m										
(84)m 7	95.91	868.91	920.57	973.58	996.91	980.47	947.12	907.36	857.50	811.64	767.74	763.15	(
7. Mean internal ter	nneratu	re (heating	r season)										
Temperature during h				rea from Tal	hla 0 Th1/	°C)						21.00	7 (
remperature during i	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	\
Utilisation factor for g				•	way	<b>54.</b> 1	<b>Ju</b> .	7108	<b>50</b> p	000		200	
_	0.99	0.98	0.96	0.91	0.78	0.58	0.38	0.40	0.68	0.91	0.98	0.99	7 (
Mean internal temp o	of living	area T1 (ste	eps 3 to 7 ii	n Table 9c)									_
_	20.35	20.45	20.60	20.77	20.90	20.95	20.96	20.95	20.94	20.80	20.53	20.37	] (
emperature during h	neating p	periods in t	he living ar	rea from Tal	ble 9, Th2('	°C)							
(88)m	20.09	20.11	20.11	20.13	20.15	20.16	20.16	20.16	20.14	20.13	20.12	20.11	] (
اtilisation factor for و	gains for	rest of dwe	elling η2,m	ı (see Table	9a)								
(89)m	0.99	0.98	0.95	0.89	0.73	0.50	0.31	0.32	0.61	0.88	0.98	0.99	] (
Лean internal tempe	rature ir	the rest of	f dwelling <sup>-</sup>	T2 (follow s	teps 3 to 7	in Table 9d	)						
(90)m	19.24	19.39	19.61	19.85	20.03	20.09	20.10	20.10	20.06	19.90	19.52	19.28	] (
iving area fraction								fLA 2	9.20	÷ (4) =	=	0.30	(
Mean internal tempe	rature fo	or the whol	e dwelling	fLA x T1 +(1	L - fLA) x T2	2							
(92)m	19.57	19.71	19.90	20.12	20.29	20.34	20.35	20.35	20.32	20.17	19.82	19.60	(
Apply adjustment to	he mea	n internal t	emperatur	e from Tab	le 4e, wher	re appropri	ate					_	_
(93)m	19.42	19.56	19.75	19.97	20.14	20.19	20.20	20.20	20.17	20.02	19.67	19.45	(
8. Space heating rec	wireme	nt											
o. space nearing rec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
et Ti to the mean int				•				_	•				e 9
Jtilisation factor for g				, , , , , , , , , , , , , , , , , , ,	,		(00)				game		
(94)m	0.98	0.97	0.95	0.88	0.73	0.51	0.31	0.32	0.61	0.88	0.97	0.99	(
 Jseful gains, ηmGm,	W = (94)	)m x (84)m						·					_
(95)m 7	83.74	846.27	871.03	860.33	723.01	497.97	293.35	293.30	523.45	711.20	745.69	752.09	] (
Monthly average exte	rnal ten	nperature f	rom Table	8			<u> </u>	•					-
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(
Heat loss rate for mea	an interr	nal tempera	ature, Lm,	W									
(97)m	148.56	1392.29	1238.92	1045.39	766.43	502.26	293.51	293.50	536.03	854.75	1193.53	1391.92	(
Space heating require	ment fo	or each mor	nth, kWh/n	month = 0.0	24 x [(97)m	n - (95)m] x	(41)m						
(98)m	94.63	366.93	273.71	133.24	32.30	0.00	0.00	0.00	0.00	106.80	322.45	476.04	
							Total ner	year (kWh/y	earl = 5(	08)1 5 10	12 -	2206.08	7 (
							Total pci	year (Revin, ye	car, - Z(	30/13, 10	12	2200.00	\

9a. Energy Req	uirements - I	Individual h	neating syst	tems includ	ling micro-	СНР							
Space heating:													
Fraction of space	e heating fro	m secondai	y/supplem	entary syst	em (Table :	11)			0.00	(201)			
Fraction of space	e heating fro	m main sys	tem(s) 1-	(201)					1.00	(202)			
Fraction of main	n heating fron	n main syst	em 2						0.00	(203)			
Fraction of total	space heat f	rom main s	ystem 1 (2	02) x [1 - (2	.03)]				1.00	(204)			
Fraction of total					,-				0.00	(205)			
Efficiency of mai				, , ,					90.60	(206)			
(from database o				propriate by	the amou	nt shown in	the 'spac	e efficiency			Table 4c)		
0	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating re	equirement, k	kWh/month	n (as calcula	ited above)									
(98)m	494.63	366.93	273.71	133.24	32.30	0.00	0.00	0.00	0.00	106.80	322.45	476.04	
Space heating fu	uel (main hea	ting system	1), kWh/m	nonth = (98	)m x (204) :	x 100 ÷ (206	5)						
(211)m	545.95	404.99	302.10	147.06	35.65	0.00	0.00	0.00	0.00	117.88	355.90	525.43	
						Т	otal per y	ear (kWh/y	ear) = ∑(2:	11)15, 10	12 = 2	2434.97	(211)
Water heating:													
Output from wa	ter heater, k	Wh/month	(calculated	d above)									
(64)m	222.60	196.43	206.84	186.18	183.00	164.30	158.55	172.94	172.31	193.02	203.14	217.50	
										∑(64)1	12 = 2	2276.81	(64)
Efficiency of wat	ter heater pe	r month											
(217)m	86.98	86.56	85.66	84.04	81.34	79.90	79.90	79.90	79.90	83.41	86.14	86.95	
Fuel for water he	eating, kWh/	month = (6	4)m x 100 ÷	- (217)m									
(219)m	255.90	226.93	241.46	221.53	224.97	205.64	198.43	216.45	215.66	231.41	235.83	250.15	
							Tota	al per year (	kWh/year	) = ∑(219)1	12 = 2	2724.37	(219)
Annual Totals Su	ummary:									kWh/ye	ear k\	Wh/year	
Space heating fu	uel used, mai	in system 1									2	2434.97	(211)
Water heating for	uel used										2	2724.37	(219)
Electricity for pu	umps, fans ar	nd electric	keep-hot (T	able 4f):									
mechanical v	entilation far	ns - balance	ed, extract o	or positive i	nput from	outside				185.62	2		(230a)
warm air hea	ating system 1	fans								0.00			(230b
central heati	ng pump									130.00	)		(230c)
oil boiler pun										0.00			(230d
boiler flue fa										45.00			(230e)
maintaining 6			for gas con	nbi boiler						0.00			(230f)
pump for sola		7								0.00	20a)	260.62	(230g)
Total electricity	for the above									∑(230a)(2	30g) [	360.62	(231)
Flactricity for 1:0	thting (color)	ated in Are	nandiy I \.									432.39	(232)
Electricity for lig	siring (calcul	αιευ ΙΙΙ Αρ	Jenuix LJ:									434.33	J (232)
10a. Fuel costs	- Individual	heating sys	tems includ	ding micro-	СНР								
					Fuel	kWh/vear		Fi	uel price		Fuel	cost £/vea	r

	Fuel kWh/year		Fuel price (Table 12)		Fuel cost £/yea	ar
Space heating - main system 1	2434.97	х	3.10	x 0.01 =	75.48	(240)
Water heating cost (other fuel)	2724.37	х	3.10	x 0.01 =	84.46	(247)
Pumps, fans and electric keep-hot	360.62	х	11.46	x 0.01 =	41.33	(249)
Energy for lighting	432.39	x	11.46	x 0.01 =	49.55	(250)
Additional standing charges (Table 12)					106.00	(251)
Total energy cost			(240)(242)	+ (245)(254)	356.82	(255)

11a. SAP rating - Individual heating systems including micro-CHP			
Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.17	(257)
SAP value		83.66	
SAP rating		84	(258)
SAP band		В	]

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	2434.97	х	0.198	=	482.12	(261)
Water heating	2724.37	х	0.198	=	539.42	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1021.55	(265)
Pumps, fans and electric keep-hot	360.62	х	0.517	=	186.44	(267)
Lighting	432.39	x	0.517	=	223.54	(268)
Total carbon dioxide emissions				∑(261)(271) =	1431.53	(272)
Dwelling carbon dioxide emissions rate				(272) ÷ (4) =	14.58	(273)
El value					86.60	
El rating (see section 14)					87	(274)
EI band					В	

13a. Primary energy - Individual heating systems is	including micro-CHP					
	Energy kWh/year		Primary Energy Factor		Primary Energy	
Space heating - main system 1	2434.97	х	1.02	=	2483.67	(261*)
Water heating	2724.37	х	1.02	=	2778.85	(264*)
Space and water heating			(261*) + (262*) + (26	53*) + (264*) =	5262.52	(265*)
Pumps, fans and electric keep-hot	360.62	x	2.92	=	1053.01	(267*)
Lighting	432.39	х	2.92	=	1262.57	(268*)
Total primary energy kWh/year			∑(2	61*)(271*) =	7578.10	(272*)
Primary energy kWh/m2/year				(272*) ÷ (4) =	77.20	(273*)

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	4 Charlotte Street, London, W1T 4QH		

Evidence			Produced by	OK?
ide emission fr	om proposed dwellin	g does not exceed the target		
	•		Authorised SAP Assessor	
DER = 12.13			Authorised SAP Assessor	
DER 12.13 < T	ER 16.29		Authorised SAP Assessor	Passe
e building fabr	ic and the heating, ho	t water and fixed lighting system	s should be no worse than the design	n limits
Element Wall Party wall Floor Roof Openings	Weighted average 0.20 (max 0.30) 0.00 (max 0.20) (no floor) (no roof) 1.57 (max 2.00)	e <b>Highest</b> 0.20 (max 0.70) N/A 2.00 (max 3.30)	Authorised SAP Assessor	Passed
		user-specified y-value of 0.14, wit	h Authorised SAP Assessor	
Mains gas, Re Potterton Pro Efficiency = 8 Minimum = 8	gular boiler from data max 24/2 HE Plus 9.60% - SEDBUK 2009 8.00%		Authorised SAP Assessor	Passed
•	0 ,		Authorised SAP Assessor	Passe
Nominal cylin Maximum pe	der loss = 1.82kWh/d rmitted cylinder loss =	= 2.10kWh/day	Additionated and Assessor	. 43361
Time and tem	perature zone contro	ol	Authorised SAP Assessor	Passe
Boiler interlo	ck (main system 1)			
	ide emission fr Fuel = Mains ; Fuel factor = : TER = 16.29 DER = 12.13  DER 12.13 < The building fabre  Element Wall Party wall Floor Roof Openings  Thermal bridg reference: test  Main heating Mains gas, Reference: test  Minimum = 8  Secondary he Cylinder volum is Nominal cylin Maximum pe Primary hot won space heating Time and term  Hot water comboiler interlood in the state of t	ide emission from proposed dwelling Fuel = Mains gas Fuel factor = 1.00 TER = 16.29  DER = 12.13  DER 12.13 < TER 16.29  e building fabric and the heating, how Weighted average Wall 0.20 (max 0.30) Party wall 0.00 (max 0.20) Floor (no floor) Roof (no roof) Openings 1.57 (max 2.00)  Thermal bridging calculated using the reference: test  Main heating system: Mains gas, Regular boiler from data Potterton Promax 24/2 HE Plus Efficiency = 89.60% - SEDBUK 2009 Minimum = 88.00%  Secondary heating system: None Cylinder volume = 180.00 litres Sounding in the proposal system in	Fuel = Mains gas Fuel factor = 1.00 TER = 16.29  DER = 12.13  DER 12.13 < TER 16.29  e building fabric and the heating, hot water and fixed lighting system  Element Weighted average Highest Wall 0.20 (max 0.30) 0.20 (max 0.70) Party wall 0.00 (max 0.20) N/A Floor (no floor) Roof (no roof) Openings 1.57 (max 2.00) 2.00 (max 3.30)  Thermal bridging calculated using user-specified y-value of 0.14, with reference: test  Main heating system: Mains gas, Regular boiler from database Potterton Promax 24/2 HE Plus Efficiency = 89.60% - SEDBUK 2009 Minimum = 88.00%  Secondary heating system: None  Cylinder volume = 180.00 litres is Nominal cylinder loss = 1.82kWh/day Maximum permitted cylinder loss = 2.10kWh/day Primary hot water pipes are insulated  Space heating control: Time and temperature zone control  Hot water control: Boiler interlock (main system 1)	dide emission from proposed dwelling does not exceed the target  Fuel = Mains gas Fuel factor = 1.00 TER = 16.29  DER = 12.13  Authorised SAP Assessor  DER 12.13 < TER 16.29  Authorised SAP Assessor  Authorised SAP Assessor  Wall 0.20 (max 0.30) 0.20 (max 0.70) Party wall 0.00 (max 0.20) N/A Floor (no floor) Roof (no roof) Openings 1.57 (max 2.00) 2.00 (max 3.30)  Thermal bridging calculated using user-specified y-value of 0.14, with reference: test  Main heating system: Mains gas, Regular boiler from database Potterton Promax 24/2 HE Plus Efficiency = 98.06% - SEDBUK 2009 Minimum = 88.00%  Secondary heating system: None  Cylinder volume = 180.00 litres Nominal cylinder loss = 1.82kWh/day Maximum permitted cylinder loss = 2.10kWh/day Primary hot water pipes are insulated  Space heating control: Time and temperature zone control  Hot water control: Boiler interlock (main system 1)

Check	Evidence	Produced by	ОК?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appro	priate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of the	e dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.2W/m <sup>2</sup> • Part Wall (0.00) Use of the following low carbon or renewable technologie • Photovoltaic array		

#### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	4 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimens	sions											
				A	rea (m²)			erage storey height (m)		Vo	olume (m³)	
owest occupied					98.16	(1a) x		3.10	(2a) =		304.30	
Total floor area	(1a) +	(1b) + (1c	) + (1d)(	1n) =	98.16	(4)						
Owelling volume							(3	sa) + (3b) + (3	c) + (3d)(3	n) =	304.30	
2. Ventilation rate												
										m	³ per hour	
lumber of chimneys								0	x 40 =		0	
Number of open flues								0	x 20 =		0	
lumber of intermittent fans	5							0	x 10 =		0	
Number of passive vents								0	x 10 =		0	
Number of flueless gas fires								0	x 40 =		0	
										Air	changes pe hour	r
nfiltration due to chimneys	, flues, fans, Ps	SVs		(6a)	+ (6b) + (7a	) + (7b) + (7	7c) =	0	÷ (5) =		0.00	
a pressurisation test has b	een carried ou	ıt or is inte	ended, pro	ceed to (17	), otherwise	continue f	rom (9)	to (16)				
ir permeability value, q50,	expressed in o	cubic metr	es per hou	ır per squa	re metre of	envelope a	rea				5.00	
f based on air permeability	value, then (1	8) = [(17)	÷ 20] + (8),	otherwise	(18) = (16)						0.25	
Air permeability value appli	es if a pressuri	sation tes	t has been	done, or a	design or s	pecified air	permeal	oility is being	used			
lumber of sides on which d	welling is shel	tered									3	
helter factor								1 -	[0.075 x (19	9)] =	0.78	
Adjusted infiltration rate									(18) x (2	0) =	0.19	
nfiltration rate modified for	monthly wind	d speed:										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spee			. = :			0 = 0	0 = -					7
(22)m 5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	

Adjusted Illineratio	Jii racc									(10) X (2		0.13	(21)
Infiltration rate me	odified for i	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind speed	from Table	7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	12 =	54.10	(22)
Wind Factor (22a)	m = (22)m -	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	12 =	13.52	(22a)
Adjusted infiltration	on rate (allo	owing for sh	elter and v	vind speed	= (21) × (2	2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	
										∑(22b)1	12 =	2.62	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

If balanced w	th heat reco	very: effici	ency in % al	lowing for	in-use fact	tor (from Ta	ble 4h) =					77.35	(23c)
a) If balanced	mechanical	ventilation	with heat r	ecovery (N	//VHR) (22	2b)m + (23b	) x [1 - (23	Bc) ÷ 100] =					
(24a)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(24a)
Effective air chan	ge rate - ent	er (24a) or	(24b) or (2	4c) or (24d	) in box (2	5)							
(25)m	0.37	0.36	0.36	0.33	0.31	0.30	0.29	0.29	0.32	0.33	0.35	0.36	(25)
3. Heat losses a	nd heat loss	paramete	r										
The κ-value is the	heat capaci	ity per unit	area, see T	able 1e.									
E	lement		Gross Area, m²	•	nings, n²	Net area A, m²		value, //m²K	A x U, W/K	K-Va	lue, n².K	Ахк, kJ/K	
\\\': *			Alea, III										(27)
Window*						13.10		1.42 =	18.54		/A	N/A	(27)
Doors						2.10		2.00 =	4.20		/A	N/A	(26)
External wall						88.03		0.20 =	17.61		/A	N/A	(29a)
Party Wall		. = 4 2				69.44	, <u> </u>	0.00 =	0.00	N,	/A	N/A	(32)
Total area of exte		_		t to control of		103.23	(31)	111/2/22/200	41	-1-22			
* for windows an	-		ve winaow	U-value is i	caicuiatea	using Jormi	ııa 1/[(1/	Uvalue)+0.0					٦ (۵۵)
Fabric heat loss,		U)						()	,	(30) + (3		40.34	<b>」(33)</b>
Heat capacity Cm								(28)		+ (32a)(32		N/A	(34)
Thermal mass pa									Calcula	ted separat	ely = [	250.00	(35)
Thermal bridges:					_ ()							14.45	(36)
if details of th		ng are not	known ther	1 (36) = 0.1	5 x (31)								7
Total fabric heat										(33) + (3	36) = [	54.80	(37)
Ventilation heat					24.24	20.24	20.27	20.27	24.00	22.26	24.72	26.40	7 (20)
(38)m	37.64	36.18	36.18	33.26	31.31	30.34	29.37	29.37	31.80	33.26	34.72	36.18	(38)
Heat transfer coe (39)m	92.43	90.97	(38)m 90.97	88.06	86.11	85.14	84.16	84.16	86.60	88.06	89.52	90.97	7
(39)111	32.43	30.37	30.37	88.00	80.11	65.14	04.10		-	∑(39)112/		88.10	」 ີ (39)
Heat less naveme	.+o~ (III D) \A	1/m²l/ (20)	m : (4)						Average –	2(39)112/	12 –	00.10	_ (59)
Heat loss parame (40)m	0.94	0.93	0.93	0.90	0.88	0.87	0.86	0.86	0.88	0.90	0.91	0.93	7
(10)	0.5 1	0.55	0.55	0.30	0.00	0.07	0.00		1	Σ(40)112/		0.90	(40)
									, werage	Z(10)112)		0.50	_ ( .0)
4. Water heatin	g energy red	quirement											
											k	Wh/year	
Assumed occupa	ncy, N									2.72	(42	)	
If TFA > 13.9,	N = 1 + 1.76	x [1 - exp(-	0.000349 x	(TFA - 13.9	) <sup>2</sup> )] + 0.00	13 x (TFA - 1	13.9)						
If TFA $\leq$ 13.9,	N = 1												
Annual average h	ot water usa	age in litres	per day Vo	,average =	(25 x N) +	36				98.84	(43	)	
Annual average I	not water us	age has be	en reduced	by 5% if th	e dwelling	is designed	to achiev	e a water us	e target of	not more th	an 125 liti	res	
per person per do	ay (all water	use, hot ar	nd cold)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage						1		1	1				7
(44)m	108.73	104.77	100.82	96.87	92.91	88.96	88.96	92.91	96.87	100.82	104.77	108.73	] 7
_								,		∑(44)1	.12 =	1186.12	(44)
Energy content o				-		_			1	1	44444	456.52	٦
(45)m	161.63	141.36	145.87	127.17	122.03	105.30	97.57	111.97	113.31	132.05	144.14	156.53	] (45)
If in other tare	water b **	a at actat	of use (== !	o++ '	toronal -	stor O in In	00 (40) +	(61)		∑(45)1	.12 = [	1558.91	(45)
If instantaneous For community h		-						(01)					
	_		.J., 1033 WIII	.anci Ui IIU	. not wate	. cann is pre	Jene						
Distribution loss (46)m	24.24	21.20	21.88	19.08	18.30	15.79	14.64	16.80	17.00	19.81	21.62	23.48	(46)
\ · = /···				20.00									_ (.0/
												StreetPV ve	
										NHF	R Plan Ass	essor version	on 5 / 1

95.13 (65)m 102.52 91.06 97.28 89.49 89.35 82.22 81.22 84.88 92.68 100.82 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains	s (see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (	Table 5), Wa	atts											
(66)m	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	163.31	(66
Lighting gains (ca	lculated in A	ppendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	61.21	54.37	44.21	33.47	25.02	21.12	22.82	29.67	39.82	50.56	59.01	62.91	(67
Appliances gains	(calculated i	n Appendix	L, equation	n L13 or L1	3a), also se	e Table 5							
(68)m	378.09	382.01	372.12	351.08	324.51	299.54	282.85	278.93	288.82	309.86	336.43	361.40	(68
Cooking gains (ca	Iculated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	54.05	(69
Pumps and fans g	gains (Table !	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70
Losses e.g. evapo	ration (nega	itive values	) (Table 5)										
(71)m	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	-108.87	(71
Water heating ga	ins (Table 5)	)											
(72)m	137.79	135.50	130.75	124.29	120.10	114.19	109.17	115.60	117.89	124.57	132.13	135.51	(72
		!				!	!	!	!	!	!	!	_

#### 6. Solar gains

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

	Α	ccess facto Table 6d	r	Area m²	So	lar flux W/	m² į	g Specific dat or Table 6b	a	FF Specific da or Table 60		Gains (W)	)
Southwest	[	0.77	x	2.70	×	37.39	x 0.9 x	0.63	х	0.70	=	30.85	(7
Northeast	[	0.77	x	6.24	x	11.51	x 0.9 x	0.63	x	0.70	=	21.95	(
Southeast	[	0.77	x	4.16	x	37.39	x 0.9 x	0.63	х	0.70	=	47.53	(
Solar gains in watts, c	alculate	d for each i	month ∑(7	4)m(82)m									
(83)m 1	00.33	178.54	254.99	346.26	408.80	427.13	413.78	364.67	292.48	208.15	121.68	84.83	(
Total gains - internal a	nd sola	r (73)m + (8	33)m										
(84)m 7	95.91	868.91	920.57	973.58	996.91	980.47	947.12	907.36	857.50	811.64	767.74	763.15	(
7. Mean internal ter	nperatu	re (heating	; season)										
Temperature during h				ea from Tal	ole 9, Th1('	°C)						21.00	] (
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for g	ains for	living area	, η1,m (see	Table 9a)					7				
(86)m	0.99	0.98	0.96	0.90	0.75	0.55	0.36	0.38	0.66	0.90	0.98	0.99	] (
Aean internal temp o	f living a	area T1 (ste	ps 3 to 7 ii	n Table 9c)									_
(87)m	20.40	20.50	20.65	20.80	20.92	20.95	20.96	20.96	20.94	20.83	20.58	20.42	_] (
emperature during h	eating p	periods in t	he living ar	ea from Tal	ole 9, Th2(°	°C)							_
(88)m	0.13	20.15	20.15	20.17	20.19	20.20	20.21	20.21	20.18	20.17	20.16	20.15	_] (
Itilisation factor for g													_
(89)m	0.99	0.98	0.95	0.88	0.70	0.48	0.29	0.31	0.58	0.87	0.97	0.99	_] (
Aean internal tempe											Г		7
(90)m	.9.35	19.50	19.70	19.93	20.09	20.13	20.14	20.14	20.11	19.97	19.62	19.39	] (
iving area fraction								fLA 2	9.20	÷ (4) =	=	0.30	] (
Mean internal tempe	i									1	Γ	1	٦.
` '	.9.66	19.80	19.98	20.19	20.34	20.38	20.38	20.38	20.36	20.23	19.91	19.69	_] (
Apply adjustment to t			-					1 1		1		1	٦,
(93)m	.9.51	19.65	19.83	20.04	20.19	20.23	20.23	20.23	20.21	20.08	19.76	19.54	_] (
8. Space heating req	uiremei	nt											
,	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
et Ti to the mean int								-	•				e 9
Jtilisation factor for g	ains, ηn	n											
(94)m	0.98	0.97	0.94	0.87	0.70	0.49	0.30	0.31	0.59	0.86	0.97	0.98	(
Jseful gains, ηmGm,	N = (94)	)m x (84)m											
(95)m 7	82.97	844.40	866.19	848.05	699.79	476.30	280.61	280.58	503.28	700.57	743.74	751.37	(
Monthly average exte	rnal ten	nperature f	rom Table	8									
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(
leat loss rate for mea	n interr	nal tempera	ature, Lm, \	W									
(97)m	87.47	1332.58	1185.84	998.68	730.81	478.93	280.69	280.69	511.67	816.98	1141.78	1332.29	] (
Space heating require	ment fo	r each mor	nth, kWh/n	nonth = 0.0	24 x [(97)m	n - (95)m] x	(41)m						
(98)m 4	49.75	328.06	237.82	108.46	23.07	0.00	0.00	0.00	0.00	86.60	286.59	432.21	
							Total per	year (kWh/ye	ear) = Σ(	98)15. 10	12 =	1952.56	7 (
							. ota. pc.	, (, ,	24.7 21	,,			_

9a. Energy Requirements - Individual heating systems include	ding micro-CHP					
Space heating:						
Fraction of space heating from secondary/supplementary syst	em (Table 11)		0.00	(201)		
Fraction of space heating from main system(s) 1 - (201)	,		1.00	(202)		
Fraction of main heating from main system 2			0.00	(203)		
· ·	002)]		1.00			
Fraction of total space heat from main system 1 (202) x [1 - (202) $\times$ (202) $\times$ (202)	:05)]			☐ (204) ☐ (205)		
Fraction of total space heat from main system 2 (202) x (203)			0.00	(205)		
Efficiency of main space heating system 1 (%)			90.60	(206)		
(from database or Table 4a/4b, adjusted where appropriate by				_		
Jan Feb Mar Apr	May Jun	Jul Aug	Sep	Oct No	ov Dec	
Space heating requirement, kWh/month (as calculated above) (98)m 449.75 328.06 237.82 108.46	23.07 0.00	0.00 0.00	0.00	86.60 286	5.59 432.21	٦
		0.00   0.00	0.00	80.00   280	0.59 432.21	
Space heating fuel (main heating system 1), kWh/month = (98	1 1 1	0.00	0.00	05 50 316	5.32 477.05	٦
(211)m 496.41 362.10 262.49 119.71	25.47   0.00	0.00 0.00				_ 
	lot	ai per year (kwh	/year) = ∑(21	1)15, 1012 =	2155.14	(211)
Water heating:						
Output from water heater, kWh/month (calculated above)						7
(64)m 222.60 196.43 206.84 186.18	183.00   164.30   1	172.9	4 172.31		3.14 217.50	
				∑(64)112 =	2276.81	(64)
Efficiency of water heater per month						7
(217)m 86.75 86.27 85.29 83.53	80.97 79.90	79.90 79.90	79.90	82.93 85	.83 86.71	
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m						7
(219)m 256.59 227.68 242.52 222.88	226.00 205.64	198.43 216.4		-	5.68 250.83	
		Total per yea	r (kWh/year)	= ∑(219)112 =	2732.09	(219)
Annual Totals Cummanu				Whh hoor	kMb/voor	
Annual Totals Summary:				kWh/year	kWh/year	7 (211)
Space heating fuel used, main system 1				kWh/year	2155.14	(211)
Space heating fuel used, main system 1 Water heating fuel used				kWh/year		(211)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot (Table 4f):					2155.14	
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive in	input from outside			185.62	2155.14	(219) (230a)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans	input from outside			185.62	2155.14	(219) (230a) (230b)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump	input from outside			185.62 0.00 130.00	2155.14	(230a) (230b) (230c)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump	input from outside			185.62 0.00 130.00 0.00	2155.14	(230a) (230b) (230c) (230d)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan	input from outside			185.62 0.00 130.00 0.00 45.00	2155.14	(230a) (230b) (230c) (230d) (230e)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler	input from outside			185.62 0.00 130.00 0.00 45.00 0.00	2155.14	(230a) (230b) (230c) (230d) (230e) (230f)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating	input from outside			185.62 0.00 130.00 0.00 45.00 0.00 0.00	2155.14 2732.09	(230a) (230b) (230c) (230d) (230e) (230f) (230g)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler	input from outside			185.62 0.00 130.00 0.00 45.00 0.00	2155.14	(230a) (230b) (230c) (230d) (230e)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above	input from outside			185.62 0.00 130.00 0.00 45.00 0.00 0.00	2155.14 2732.09	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):				185.62 0.00 130.00 0.00 45.00 0.00 0.00	2155.14 2732.09	(230a) (230b) (230c) (230d) (230e) (230f) (230g)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and				185.62 0.00 130.00 0.00 45.00 0.00 0.00	2155.14 2732.09 360.62	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):				185.62 0.00 130.00 0.00 45.00 0.00 0.00	2155.14 2732.09	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans  central heating pump  oil boiler pump  boiler flue fan  maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and	d Q):			185.62 0.00 130.00 0.00 45.00 0.00 0.00	2155.14 2732.09 360.62	(230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Electricity generated by PVs (Appendix M) (negative quantity)	d Q):		Fuel price (Table 12)	185.62 0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(230g)	2155.14 2732.09 360.62	(219) (230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-	d Q): CHP Fuel kWh/year	x	-	185.62 0.00 130.00 0.00 45.00 0.00 0.00 Σ(230a)(230g)	2155.14 2732.09 360.62 432.39	(219) (230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-	d Q):  CHP  Fuel kWh/year  2155.14		(Table 12) 3.10	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g)	2155.14 2732.09 360.62 432.39 -657.28	(219) (230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232) (233)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-  Space heating - main system 1  Water heating cost (other fuel)	d Q): Fuel kWh/year  2155.14  2732.09	x	3.10 3.10	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g) x 0.01 = x 0.01 =	2155.14 2732.09  360.62  432.39  -657.28  Fuel cost £/yea 66.81 84.69	(219) (230a) (230b) (230c) (230d) (230e) (230f) (2331) (232) (233)
Space heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro- Space heating - main system 1  Water heating cost (other fuel)  Pumps, fans and electric keep-hot	d Q):  Fuel kWh/year  2155.14  2732.09  360.62	x	3.10 3.10 11.46	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g) x 0.01 = x 0.01 = x 0.01 =	2155.14 2732.09  360.62  432.39  -657.28  Fuel cost £/yea 66.81 84.69 41.33	(219) (230a) (230b) (230c) (230d) (230e) (230f) (230g) (231) (232) (233)
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive is warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L): Energy saving/generation technologies (Appendices M, N and Electricity generated by PVs (Appendix M) (negative quantity)  10a. Fuel costs - Individual heating systems including micro-  Space heating - main system 1  Water heating cost (other fuel)	d Q): Fuel kWh/year  2155.14  2732.09	x	3.10 3.10	185.62 0.00 130.00 0.00 45.00 0.00 Σ(230a)(230g) x 0.01 = x 0.01 =	2155.14 2732.09  360.62  432.39  -657.28  Fuel cost £/yea 66.81 84.69	(219) (230a) (230b) (230c) (230d) (230e) (230f) (2331) (232) (233)

PV savings (negative quantity)	-657.28	х	11.46 x 0.01 =	-75.32	(252)
Total energy cost	037.20	^	(240)(242) + (245)(254		(255)
			(240)(242) + (243)(23	4) 273.00	(233
11a. SAP rating - Individual heating systems including mid	cro-CHP				
Energy cost deflator (Table 12)				0.47	(256)
Energy cost factor (ECF)			[(255) x (256)] ÷ [(4) + 45.0]	= 0.90	(257)
SAP value				87.49	
SAP rating				87	(258)
SAP band				В	
12a. Carbon dioxide emissions - Individual heating system	ns including micro-CHP				
	Energy		Emissions	Emissions	
	kWh/year		Factor	(kgCO2/year)	
Space heating - main system 1	2155.14	Х	0.198 =	426.72	(261)
Water heating	2732.09	х	0.198 =	540.95	(264)
Space and water heating			(261) + (262) + (263) + (264)	= 967.67	(265)
Pumps, fans and electric keep-hot	360.62	х	0.517 =	186.44	(267)
Lighting	432.39	x	0.517 =	223.54	(268
Energy saving/generation technologies:					
PV emission savings (negative quantity)	-657.28	х	0.529 =	-347.70	(269)
Total carbon dioxide emissions			∑(261)(271)	= 1029.96	(272)
Dwelling carbon dioxide emissions rate			(272) ÷ (4)	= 10.49	(273)
El value				90.36	
El rating (see section 14)				90	(274)
El band				В	
13a. Primary energy - Individual heating systems includin	ng micro-CHP				
	Energy kWh/year		Primary Energy Factor	Primary Energ	у
Space heating - main system 1	2155.14	x	1.02 =	2198.24	(261
Water heating	2732.09	х	1.02 =	2786.74	(264
Space and water heating			(261*) + (262*) + (263*) + (264*)	= 4984.98	(265
Pumps, fans and electric keep-hot	360.62	х	2.92 =	1053.01	(267
Lighting	432.39	х	2.92 =	1262.57	(268
Energy saving/generation technologies:					
PV primary energy savings (negative quantity)	-657.28	х	2.92 =	-1919.26	(269
Total primary energy kWh/year			∑(261*)(271*)	= 5381.31	(272
Primary energy kWh/m2/year			(272*) ÷ (4)	= 54.82	(273

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	5 Charlotte Street, London, W1T 4QH		

Check	Evidence			Produced by	OK?
Criterion 1: predicted carbon dioxi	le emission from prop	osed dwellii	ng does not exceed the target		
	Fuel = Mains gas Fuel factor = 1.00 TER = 20.26			Authorised SAP Assessor	
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 19.98			Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 19.98 < TER 20.2	6		Authorised SAP Assessor	Passed
Criterion 2: the performance of the	building fabric and th	e heating, h	ot water and fixed lighting systems	should be no worse than the design	n limits
Fabric U-values					
Are all U-values better than the design limits in Table 2?	Wall 0.30 Party wall 0.00 Floor (no fl Roof 0.13	hted averag (max 0.30) (max 0.20) oor) (max 0.20) (max 2.00)	9e Highest 0.30 (max 0.70) N/A 0.13 (max 0.35) 2.00 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging					
How has the loss from thermal bridges been calculated?	Thermal bridging calc reference: test	ulated using	user-specified y-value of 0.08, with	Authorised SAP Assessor	
Heating and hot water systems					
Compliance Guide?		oiler from da /2 HE Plus SEDBUK 200		Authorised SAP Assessor	Passed
Does the insulation of the hot water cylinder meet the standards	Cylinder volume = 13!	5.00 litres = 1.50kWh/ cylinder loss	= 1.77kWh/day	Authorised SAP Assessor	Passed
controls provision set out in the Domestic Heating Compliance	Space heating control Time and temperatur Hot water control:		rol	Authorised SAP Assessor	Passed
	Boiler interlock (main Cylinder thermostat Separate water contro				

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting complewith paragraphs 42 to 44?	y Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appro	opriate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of th	e dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 4.50 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered in practice?	The following walls/wall have a U-value less than 0.2W/m²K:  • Part Wall (0.00)  Design air permeability of 4.5 m³/(h.m²) is less than 5 m³/(h.m²) at 50 Pa	Authorised SAP Assessor	

#### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	5 Charlotte Street, London, W1T 4QH		

1. Overall dwelling dimen	nsions						
		Area (m²)		Average storey height (m)		Volume (m³)	
owest occupied		82.24	(1a) x	3.10	(2a) =	254.94	(3
otal floor area	(1a) + (1b) + (1c) + (1d)(	1n) = 82.24	(4)				
Owelling volume				(3a) + (3b) + (3d	c) + (3d)(3n) =	254.94	(5
2. Ventilation rate							
						m³ per hour	
lumber of chimneys				0	x 40 =	0	(6
lumber of open flues				0	x 20 =	0	(6
lumber of intermittent far	15			0	x 10 =	0	(7
lumber of passive vents				0	x 10 =	0	(7
Number of flueless gas fire	S			0	x 40 =	0	(7
						Air changes pe hour	er
nfiltration due to chimney	s, flues, fans, PSVs	(6a) + (6b) + (7a)	+ (7b) + (7c) =	0	÷ (5) =	0.00	(8
a pressurisation test has	been carried out or is intended, pro	ceed to (17), otherwise	continue from	(9) to (16)			
ir permeability value, q50	, expressed in cubic metres per hou	ur per square metre of e	nvelope area			4.50	(1
based on air permeability	y value, then (18) = $[(17) \div 20] + (8)$	, otherwise (18) = (16)				0.22	(1
ir permeability value appl	lies if a pressurisation test has been	done, or a design or spe	ecified air perr	neability is being ເ	used		
lumber of sides on which	dwelling is sheltered					3	(1
helter factor				1 -	[0.075 x (19)] =	0.78	(2
djusted infiltration rate					(18) x (20) =	0.17	(2
nfiltration rate modified fo	or monthly wind speed:						
Jan	Feb Mar Apr	May Jun	Jul A	Aug Sep	Oct N	ov Dec	
Monthly average wind spe	ed from Table 7						

-													
Infiltration rate me	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v	wind speed	from Table	2 7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	
										∑(22)1	12 =	54.10	(22)
Wind Factor (22a)	m = (22)m	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	
										∑(22a)1	12 =	13.52	(22a)
Adjusted infiltration	n rate (allo	owing for sl	nelter and v	wind speed	) = (21) × (2	2a)m							_

					(, (-	,						
(22b)m	0.24	0.22	0.22	0.20	0.18	0.17	0.16	0.16	0.18	0.20	0.21	0.2

 $\Sigma$ (22b)1...12 = 2.36 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system

0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

If balanced with h	neat recover	ry: efficie	ency in % al	llowing for	in-use fact	or (from Ta	ble 4h) =					77.35	(23c)
a) If balanced me	chanical vei	ntilation	with heat r	ecovery (N	//VHR) (22	b)m + (23b	x [1 - (23	c) ÷ 100] =					
(24a)m	0.35	0.34	0.34	0.31	0.29	0.28	0.27	0.27	0.30	0.31	0.32	0.34	(24a)
Effective air change r	rate - enter	(24a) or	(24b) or (2	4c) or (24d	) in box (25	5)							
(25)m	0.35	0.34	0.34	0.31	0.29	0.28	0.27	0.27	0.30	0.31	0.32	0.34	(25)
3. Heat losses and h	neat loss pa	rameter											
The κ-value is the hea	at capacity	per unit	area, see T	able 1e.									
Elem	ent		Gross Area, m²	•	nings, n²	Net area A, m²		ralue, /m²K	A x U, W/K		nlue, m².K	Ахк, kJ/K	
Window*						13.40	x 1	.42 =	18.96	N	/A	N/A	(27)
Doors						2.10	x 2	.00 =	4.20	N	/A	N/A	(26)
External wall						87.73	x 0	.30 =	26.32	N	/A	N/A	(29a)
Party Wall						57.04	x 0	.00 =	0.00	N	/A	N/A	(32)
Roof						82.24	x 0	.13 =	10.69	N	/A	N/A	(30)
Total area of externa	l elements	∑A, m²				185.47	(31)						
* for windows and ro	of windows	s, effectiv	ve window	U-value is	calculated	using formเ	ıla 1/[(1/U	Value)+0.04	l] paragrap	oh 3.2			
Fabric heat loss, W/K	$C = \sum (A \times U)$								(2	6)(30) + (	32) =	60.17	(33)
Heat capacity Cm = ∑	<u>(</u> (Ахк)							(28)	(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass param	eter (TMP)	in kJ/m²	K						Calcula	ted separat	ely =	250.00	(35)
Thermal bridges: ∑(L  if details of therm					5 v (31)							14.84	(36)
Total fabric heat loss		ure not i	CHOWII THEI	1 (30) – 0.1	3 X (31)					(33) + (	26) -	75.01	(27)
		، با ما شمی می میں	0.22/25	٠١,,,, (٦)						(33) + (	30) = [	75.01	(37)
` '	29.33	28.23	28.23	26.03	24.57	23.83	23.10	23.10	24.93	26.03	27.13	28.23	(38)
Heat transfer coeffici				404.04	00.50	00.04	00.44	00.11	00.04	101.01	102.11	102.24	7
(39)m	104.34   1	103.24	103.24	101.04	99.58	98.84	98.11	98.11	99.94	7(20)1 12	102.14	103.24	] ] (20)
Heat loss parameter	(HLP), W/m	n²K (39)	m ÷ (4)						Average –	∑(39)112,	/12	101.07	<b>(39)</b>
(40)m	1.27	1.26	1.26	1.23	1.21	1.20	1.19	1.19	1.22	1.23	1.24	1.26	
									Average =	∑(40)112,	/12 =	1.23	(40)
4. Water heating er	nergy requi	rement											
											k	:Wh/year	
Assumed occupancy,	, N									2.50	(42	2)	
If TFA > 13.9, N =	1 + 1.76 x [	1 - exp(-0	0.000349 x	(TFA - 13.9	) <sup>2</sup> )] + 0.001	13 x (TFA - 1	.3.9)						
If TFA ≤ 13.9, N =	1												
Annual average hot v	water usage	e in litres	per day Vd	l,average =	(25 x N) +	36				93.67	7 (43	3)	
Annual average hot we per person per day (c	_			by 5% if th	e dwelling i	is designed	to achieve	a water us	e target of	not more tl	nan 125 lit	res	
per person per day (o	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in li					•		301	Aug	Scp	Ott	1404	Dec	
_		99.29	95.54	91.80	88.05	84.30	84.30	88.05	91.80	95.54	99.29	103.04	]
	l				•	•		•		Σ(44)1	.12 =	1124.04	(44)
Energy content of ho	ot water use	ed - calcu	lated mont	thlv = 4.190	) x Vd.m x ı	nm x Tm/36	00 kWh	month (see	Tables 1b.				_ ` '
		133.96	138.23	120.52	115.64	99.79	92.47	106.11	107.37	125.14	136.59	148.33	]
										∑(45)1	.12 =	1477.32	(45)
If instantaneous wat	er heating a	at point d	of use (no h	ot water si	torage), en	ter 0 in box	es (46) to (	(61)		<u></u> · ,			
For community heati	ing include o	distributi	on loss whe	ether or no	t hot wate	r tank is pre	sent						
Distribution loss 0.1	5 x (45)m												

(46)m	22.97	20.09	20.74	18.08	17.35	14.97	13.87	15.92	16.11	18.77	20.49	22.25	(46)
Water storage lo	oss:												
b) If manufactur	er's declared	cylinder lo	ss factor is	not known	:								
Cylinder volu	me (litres) in	cluding any	/ solar stora	age within s	ame cylind	er			135.00	(50)			
If community	heating and	no tank in	dwelling, e	nter 110 lit	res in box (	50)							
Otherwise if I	no stored hot	t water (thi	s includes ir	nstantaneo	us combi bo	oilers) ente	r '0' in box	(50)					
Hot water sto	orage loss fac	ctor from Ta	able 2 (kWh	n/litre/day)					0.01	(51)			
If community	heating see	SAP 2009 s	ection 4.3										
Volume facto	or from Table	2a							0.96	(52)			
Temperature	factor from	Table 2b							0.54	(53)			
Energy lost fr	om water sto	orage, kW	h/day (50)	) x (51) x (5	2) x (53)				0.81	(54)			
Enter (49) or (54	) in (55)								0.81	(55)			
Water storage lo	oss calculated	d for each n	nonth = (55	) x (41)m						-			
(56)m	25.09	22.66	25.09	24.28	25.09	24.28	25.09	25.09	24.28	25.09	24.28	25.09	(56)
If cylinder contain	ins dedicated	d solar stora	age, = (56)n	n x [(50) - (H	H11)] ÷ (50)	, else = (56	)m where (	H11) is fro	n Appendix	кН			
(57)m	25.09	22.66	25.09	24.28	25.09	24.28	25.09	25.09	24.28	25.09	24.28	25.09	(57)
Primary circuit lo	oss (annual) f	rom Table	3						360.00	(58)			
Primary circuit lo	oss for each r	month (58)	÷ 365 × (41	.)m									
(modified by fac	tor from Tab	le H5 if the	re is solar w	vater heatir	ng and a cyl	linder theri	mostat)						_
(59)m	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)
Combi loss for ea	ach month fr	om Table 3	a, 3b or 3c	(enter '0' if	not a coml	bi boiler)							_
(61)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
Total heat requir						15)m + (46)	m + (57)m ·	+ (59)m + (6	51)m				_
(62)m	208.83	184.24	193.90	174.39	171.31	153.66	148.13	161.77	161.25	180.80	190.47	204.00	(62)
Solar DHW input		ising Apper								1			7
(63)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
										∑(63)1	.12 =	0.00	(63)
Output from war	ter heater fo		th, kWh/m	onth (62)m	n + (63)m								7
(64)m	208.83	184.24	193.90	174.39	171.31	153.66	148.13	161.77	161.25	180.80	190.47	204.00	
										∑(64)1	.12 = 2	132.75	(64)
if (64)m < 0 then	set to 0												
Heat gains from	water heatin	ng, kWh/mo		[0.85 × (45	5)m + (61)m	$[-1] + 0.8 \times [(-1)^{-1}]$	46)m + (57)	m + (59)m]					_
(65)m	95.46	84.77	90.50	83.17	82.98	76.28	75.28	79.81	78.80	86.14	88.51	93.85	(65)
include (5	7)m in calcul	ation of (65	5)m only if o	cylinder is ir	n the dwelli	ng or hot w	vater is fror	n communi	ty heating				
5. Internal gain	s (see Table	5 and 5a)											
-3. Internal gain			Mar	An-	May	lun	11	Λα	Son	Oct	Nov	Doc	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

E lutamal sains	lasa Tabla I	F and Fal											
5. Internal gains	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (T			IVIGI	Zbi	ividy	Jun	Jui	Aug	ЗСР	Oct	1404	Dec	
(66)m	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	(66)
Lighting gains (cald	culated in A	ppendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	51.91	46.11	37.50	28.39	21.22	17.92	19.36	25.16	33.77	42.88	50.05	53.36	(67)
Appliances gains (	calculated i	n Appendix	L, equatio	n L13 or L1	3a), also se	e Table 5							
(68)m	334.42	337.89	329.14	310.52	287.02	264.94	250.18	246.71	255.46	274.07	297.57	319.66	(68)
Cooking gains (cale	culated in A	ppendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	(69)
Pumps and fans ga	ins (Table !	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evapor	ation (nega	tive values	) (Table 5)										
(71)m	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	(71)
Water heating gains (Table 5)													

(72)m	128.31	126.14	121.64	115.51	111.54	105.94	101.18	107.28	109.44	115.78	122.94	126.15 (72
Total internal gain												,
(73)m	627.25	622.74	600.88	567.03	532.39	501.40	483.33	491.76	511.28	545.35	583.17	611.77 (73
6. Solar gains												
Solar gains are cal	culated us	ina solar flu	x from Tab	le 6a and a	ssociated e	auations to	convert to	the applica	able oriento	ation.		
Rows (74) to (82)		-	-									
Details for month			-		_				,,			
		Access facto	or	Area m²	So	lar flux W/	m² g	Specific da	ta FF	Specific da	ita	Gains (W)
		Table 6d						or Table 6k		or Table 60		
Southwest		0.77	x	3.00	] x	37.39	x 0.9 x	0.63	x	0.70	=	34.28 (79
Northeast		0.77	x	6.24	x	11.51	x 0.9 x	0.63	x	0.70	=	21.95 (75
Southeast		0.77	x	4.16	x	37.39	x 0.9 x	0.63	] x	0.70	=	47.53 (77
Solar gains in watt	s, calculate	ed for each	month ∑(7₄	4)m(82)m	1							
(83)m	103.76	184.38	262.71	355.75	419.19	437.68	424.12	374.33	301.00	214.79	125.79	87.76 (83
Total gains - interr	nal and sola	ar (73)m + (8	83)m									
(84)m	731.01	807.13	863.59	922.78	951.58	939.08	907.45	866.09	812.28	760.13	708.96	699.54 (84
7. Mean internal	temperat	ure (heating	g season)									
Temperature duri	ng heating	periods in t	he living ar	ea from Ta	ble 9, Th1('	°C)						21.00 (85
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor f	or gains fo	r living area	, η1,m (see	Table 9a)								
(86)m	0.99	0.98	0.96	0.92	0.82	0.64	0.44	0.46	0.74	0.93	0.98	0.99 (86
Mean internal tem	np of living	area T1 (ste	eps 3 to 7 ir	n Table 9c)								
(87)m	20.10	20.22	20.41	20.61	20.82	20.92	20.94	20.94	20.89	20.67	20.32	20.13 (87
Temperature duri	ng heating	periods in t	he living ar	ea from Ta	ble 9, Th2('	°C)						
(88)m	19.87	19.88	19.88	19.90	19.91	19.92	19.93	19.93	19.91	19.90	19.89	19.88 (88
Utilisation factor f	or gains fo	r rest of dw	elling η2,m	(see Table	9a)							
(89)m	0.99	0.98	0.95	0.90	0.76	0.54	0.33	0.34	0.65	0.90	0.97	0.99 (89
Mean internal tem	nperature i	in the rest o	f dwelling 1	Γ2 (follow s	teps 3 to 7	in Table 9c	)					
(90)m	18.70	18.87	19.14	19.44	19.71	19.82	19.85	19.85	19.79	19.52	19.03	18.74 (90
Living area fraction	n							fLA	32.95	÷ (4) =	=	0.40 (91
Mean internal tem	nperature f	for the whol	e dwelling	fLA x T1 +(:	1 - fLA) x T2	2						
(92)m	19.26	19.41	19.65	19.91	20.16	20.26	20.28	20.28	20.23	19.98	19.55	19.30 (92
Apply adjustment	to the mea	an internal t	emperatur	e from Tab	le 4e, wher	e appropri	ate					
(93)m	19.11	19.26	19.50	19.76	20.01	20.11	20.13	20.13	20.08	19.83	19.40	19.15 (93
8. Space heating	requireme	ent										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Set Ti to the mean			obtained a	it step 11 o	f Table 9b,	so that tim	= (93)m ar	nd recalcula	te the utilis	sation facto	or for gains	using Table 9a)
Utilisation factor f		_			1	1	1		1	1	ı	
(94)m	0.98	0.97	0.95	0.90	0.77	0.56	0.35	0.36	0.66	0.89	0.97	0.98 (94
Useful gains, ηmG	· `	, , , ,									1	
(95)m	718.33	784.62	817.71	826.31	728.50	527.62	316.09	315.77	539.87	678.57	688.12	688.11 (95
Monthly average 6				8								
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90 (96
Heat loss rate for	mean inter	nal tempera	ature, Lm, \	W								
(97)m	1524.64	1472.51	1311.28	1117.73	827.11	544.58	317.32	317.27	577.35	912.41	1266.61	1470.77 (97
Space heating req	uirement f	or each mor	nth, kWh/n	nonth = 0.0	24 x [(97)m	n - (95)m] x	(41)m					
(98)m	599.90	462.27	367.21	209.82	73.36	0.00	0.00	0.00	0.00	173.98	416.51	582.30
							Total per y	year (kWh/	year) = ∑(98	3)15, 10	12 =	2885.35 (98
Space heating req	uirement i	n kWh/m²/y	vear .							(98)	÷ (4)	35.08 (99
										LIDAL	· E Charlot	

9a. Energy Req	uirements - I	Individual h	neating syst	ems includ	ling micro-	СНР							
Space heating:													
Fraction of space	e heating fro	m secondar	y/suppleme	entary syst	em (Table 1	11)			0.00	(201)			
Fraction of space	e heating fro	m main sys	tem(s) 1 - (	(201)					1.00	(202)			
Fraction of main	heating fron	n main syst	em 2						0.00	(203)			
Fraction of total	space heat fi	rom main s	ystem 1 (20	02) x [1 - (2	03)]				1.00	(204)			
Fraction of total	space heat fi	rom main s	ystem 2 (20	02) x (203)					0.00	(205)			
Efficiency of mai	in space heat	ing system	1 (%)						90.60	(206)			
(from database	or Table 4a/4	lb, adjusted	d where app	ropriate by	the amou	nt shown ir	the 'space	e efficiency	adjustmer	— nt' column of T	able 4c)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating re	equirement, k	wh/month	n (as calcula	ted above)									
(98)m	599.90	462.27	367.21	209.82	73.36	0.00	0.00	0.00	0.00	173.98	416.51	582.30	
Space heating fu	ıel (main hea	ting system	1), kWh/m	onth = (98	)m x (204) :	x 100 ÷ (20	6)						_
(211)m	662.14	510.23	405.31	231.59	80.97	0.00	0.00	0.00	0.00	192.03	459.73	642.72	
						7	otal per ye	ear (kWh/y	ear) = ∑(23	11)15, 101	2 = 3	3184.72	(211
Water heating:													
Output from wa	ter heater, k\	Wh/month	(calculated	above)									,
(64)m	208.83	184.24	193.90	174.39	171.31	153.66	148.13	161.77	161.25	180.80	190.47	204.00	
										∑(64)11	2 = 2	2132.75	(64)
Efficiency of wat	ter heater pe	r month											,
(217)m	87.57	87.27	86.59	85.41	82.83	79.90	79.90	79.90	79.90	84.81	86.95	87.56	
Fuel for water h		1											1
(219)m	238.47	211.12	223.92	204.18	206.81	192.31	185.40	202.47	201.81	213.18	219.06	232.99	
							Tota	l per year (	kWh/year	) = ∑(219)112	2 = 2	2531.73	(219
Annual Totals Su	ummary:									kWh/yea	r k\	Wh/year	-
Space heating fu	uel used, mai	in system 1									3	3184.72	(211
Water heating f	uel used										2	2531.73	(219
Electricity for pu	ımps, fans ar	nd electric l	keep-hot (T	able 4f):									
mechanical v	entilation far	ns - balance	ed, extract o	r positive i	nput from	outside				155.52			(230
warm air hea		fans								0.00			(230
central heati										130.00			(230
oil boiler pun										0.00	=		(230
boiler flue fa		hat facility	for gas as	hi hailar						45.00	=		(230
maintaining e			ior gas com	ibi boller						0.00	=		(230) (230)
Total electricity		7								Σ(230a)(230	 )g)	330.52	(230)
. Star creatificity	. 51 1110 05000									212300/(230	-01	230.32	, ,251
Electricity for lig	thting (calcul	ated in Apr	endix L):									366.73	(232
	, - 0 (		<b>-,</b> -										,
10a. Fuel costs	- Individual I	heating sys	tems includ	ling micro-	СНР								
					Fuel	kWh/year		Fi	uel price		Fuel	cost £/yea	r

10a. Fuel costs - Individual heating systems including micro-CHP										
Fuel kWh/year		Fuel price (Table 12)		Fuel cost £/yea	r					
3184.72	x	3.10	x 0.01 =	98.73	(240)					
2531.73	x	3.10	x 0.01 =	78.48	(247)					
330.52	x	11.46	x 0.01 =	37.88	(249)					
366.73	x	11.46	x 0.01 =	42.03	(250)					
				106.00	(251)					
		(240)(242)	+ (245)(254)	363.11	(255)					
	3184.72 2531.73 330.52	3184.72 x 2531.73 x 330.52 x	(Table 12)  3184.72	(Table 12)  3184.72	(Table 12)  3184.72					

11a. SAP rating - Individual heating systems including micro-CHP			
Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.34	(257)
SAP value		81.29	]
SAP rating		81	(258)
SAP band		В	]

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	3184.72	x	0.198	=	630.57	(261)
Water heating	2531.73	x	0.198	=	501.28	(264)
Space and water heating			(261) + (262) +	(263) + (264) =	1131.86	(265)
Pumps, fans and electric keep-hot	330.52	x	0.517	=	170.88	(267)
Lighting	366.73	x	0.517	=	189.60	(268)
Total carbon dioxide emissions				∑(261)(271) =	1492.33	(272)
Dwelling carbon dioxide emissions rate				(272) ÷ (4) =	18.15	(273)
El value					84.28	
El rating (see section 14)					84	(274)
El band					В	

	Energy kWh/year		Primary Energy Factor		Primary Energy	
Space heating - main system 1	3184.72	Х	1.02	=	3248.41	(261*)
Water heating	2531.73	х	1.02	=	2582.36	(264*)
Space and water heating			(261*) + (262*) + (2	263*) + (264*) =	5830.77	(265*)
Pumps, fans and electric keep-hot	330.52	х	2.92	=	965.11	(267*)
Lighting	366.73	х	2.92	=	1070.84	(268*)
Total primary energy kWh/year			Σ(	261*)(271*) =	7866.72	(272*)
Primary energy kWh/m2/year				(272*) ÷ (4) =	95.66	(273*)

## **Design - Draft**



Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	5 Charlotte Street, London, W1T 4QH		

Check	Evidence		Produced by	ОК?
Criterion 1: predicted carbon dioxi	e emission from proposed dw	velling does not exceed the target		
TER (kg CO₂/m².a)	Fuel = Mains gas		Authorised SAP Assessor	
	Fuel factor = 1.00			
	ΓER = 20.26			
DER for dwelling as designed (kg CO <sub>2</sub> /m².a)	DER = 15.02		Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 15.02 < TER 20.26		Authorised SAP Assessor	Passe
Criterion 2: the performance of the	building fabric and the heatir	g, hot water and fixed lighting systems sho	ould be no worse than the design	limits
abric U-values				
Are all U-values better than the	Element Weighted av	erage Highest	Authorised SAP Assessor	Passe
design limits in Table 2?	Wall 0.20 (max 0.3			
	Party wall 0.00 (max 0.2	0) N/A		
	Floor (no floor)			
	Roof 0.13 (max 0.2			
	Openings 1.57 (max 2.0	0) 2.00 (max 3.30)		
Thermal bridging				
How has the loss from thermal bridges been calculated?	Thermal bridging calculated u reference: test	sing user-specified y-value of 0.09, with	Authorised SAP Assessor	
Heating and hot water systems				
Does the efficiency of the heating	Main heating system:		Authorised SAP Assessor	Passe
systems meet the minimum value	Mains gas, Regular boiler fron	n database		
set out in the Domestic Heating	Potterton Promax 24/2 HE Plu	IS		
Compliance Guide?	Efficiency = 89.60% - SEDBUK	2009		
	Minimum = 88.00%			
	Secondary heating system: No	one		
Does the insulation of the hot	Cylinder volume = 135.00 litre		Authorised SAP Assessor	Passe
water cylinder meet the standards	Nominal cylinder loss = 1.50k\	Wh/day		
set out in the Domestic Heating	Maximum permitted cylinder	loss = 1.77kWh/day		
Compliance Guide?	Primary hot water pipes are in	nsulated		
Do controls meet the minimum	Space heating control:		Authorised SAP Assessor	Passe
controls provision set out in the Domestic Heating Compliance	Fime and temperature zone o	ontrol		
Guide?	Hot water control:			
	Boiler interlock (main system	1)		
	Cylinder thermostat			
	Separate water control			

Check	Evidence	Produced by	ОК?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 20  Percentage of low energy lights = 100 % Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appro	priate passive control measures to limit solar gains		
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = Dark-coloured curtain or roller blind	Authorised SAP Assessor	Passed
Criterion 4: the performance of the	e dwelling, as designed, is consistent with the DER		
Design air permeability (m³/(h.m²) at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Mechanical ventilation with heat recovery:  SFP = 0.40 W/(litre/sec)  Max SFP = 1.5 W/(litre/sec)  Heat recovery efficiency = 91.00 %  Min heat recovery efficiency = 70.00 %	Authorised SAP Assessor	Passed
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.2W/m² • Part Wall (0.00) Use of the following low carbon or renewable technologies • Photovoltaic array		

#### **Design - Draft**



This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Vanson	Assessor number	6290
Client		Last modified	14/02/2012
Address	5 Charlotte Street, London, W1T 4QH		

1. Overall dwelling	ng dimensi	ions											
					А	rea (m²)			rage storey eight (m)		Vo	lume (m³)	
Lowest occupied						82.24	(1a) x		3.10	(2a) =		254.94	(:
Total floor area		(1a)	+ (1b) + (1	c) + (1d)(	1n) =	82.24	(4)						
Dwelling volume								(3a	) + (3b) + (3	c) + (3d)(3	n) =	254.94	(!
2. Ventilation rat	te												
											m	<sup>3</sup> per hour	
Number of chimne	eys								0	x 40 =		0	(
Number of open f	lues								0	x 20 =		0	(
lumber of interm	ittent fans								0	x 10 =		0	(
Number of passive	e vents								0	x 10 =		0	(
Number of flueles	s gas fires								0	x 40 =		0	(
											Air	changes pe hour	r
nfiltration due to	chimneys,	flues, fans,	PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (7	7c) =	0	÷ (5) =		0.00	(8
a pressurisation	test has be	en carried	out or is int	ended, pro	ceed to (17	), otherwise	e continue j	from (9) to	(16)				
ir permeability v	alue, q50, e	expressed in	n cubic met	res per hou	ur per squa	re metre of	envelope a	irea				5.00	(:
f based on air per	meability v	alue, then	(18) = [(17)	÷ 20] + (8)	, otherwise	(18) = (16)						0.25	(:
Air permeability vo	alue applie:	s if a pressu	risation tes	t has been	done, or a	design or s	pecified air	permeabi	lity is being	used			
lumber of sides o	n which dv	welling is sh	eltered									3	(:
helter factor									1 -	[0.075 x (19	9)] =	0.78	(2
Adjusted infiltration	on rate									(18) x (2	(0) =	0.19	(2
nfiltration rate me	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average v						1	Г		1	1 1			7
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	

										(/ (-	,		\/
Infiltration rate m	odified for	monthly wi	nd speed:										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	wind speed	from Table	7										
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10	]
										∑(22)1	.12 =	54.10	(22)
Wind Factor (22a)	m = (22)m	÷ 4											
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27	]
										∑(22a)1	.12 =	13.52	(22a)
Adjusted infiltration	on rate (allo	owing for sh	elter and v	vind speed	) = (21) × (2	2a)m							
(22b)m	0.26	0.25	0.25	0.22	0.20	0.19	0.18	0.18	0.20	0.22	0.23	0.25	
										∑(22b)1	.12 =	2.62	(22b)

Calculate effective air change rate for the applicable case: If mechanical ventilation: air change rate through system

0.50

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)

(23a)

If balanced with heat recovery: efficiency in % allow	ing for in-use factor (from	Table 4h) =		77.35	(23c)
a) If balanced mechanical ventilation with heat reco	very (MVHR) (22b)m + (2	3b) x [1 - (23c) ÷ 100] =			
(24a)m 0.37 0.36 0.36 (	0.33 0.31 0.30	0.29 0.29	0.32 0.33	0.35 0.36	(24a)
Effective air change rate - enter (24a) or (24b) or (24c)	or (24d) in box (25)				
(25)m 0.37 0.36 0.36 0	0.33 0.31 0.30	0.29 0.29	0.32 0.33	0.35 0.36	(25)
3. Heat losses and heat loss parameter					
The κ-value is the heat capacity per unit area, see Table	? 1e.				
Element Gross Area, m²	Openings, Net ar m <sup>2</sup> A, m		,	value, Α x κ, /m².K kJ/K	
Window*	13.4	x 1.42 =	18.96	N/A N/A	(27)
Doors	2.10	x 2.00 =	4.20	N/A N/A	(26)
External wall	87.7	x 0.20 =	17.55	N/A N/A	(29a)
Party Wall	57.0	x 0.00 =	0.00	N/A N/A	(32)
Roof	82.2	x 0.13 =	10.69	N/A N/A	(30)
Total area of external elements $\Sigma A$ , $m^2$	185.4	7 (31)			
* for windows and roof windows, effective window U-ve	alue is calculated using fo	mula 1/[(1/UValue)+0.0	4] paragraph 3.2		
Fabric heat loss, W/K = $\Sigma$ (A × U)			(26)(30) +	(32) = 51.40	(33)
Heat capacity Cm = $\sum$ (A x $\kappa$ )		(28)	.(30) + (32) + (32a)(	32e) = N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K			Calculated separa	ately = 250.00	(35)
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using Appendix K				16.69	(36)
if details of thermal bridging are not known then (36	5) = 0.15 x (31)				
Total fabric heat loss			(33) +	(36) = 68.09	(37)
Ventilation heat loss calculated monthly 0.33 x (25)m	x (5)				
(38)m 31.53 30.31 30.31 2	7.87 26.24 25.4	24.61 24.61	26.64 27.87	29.09 30.31	(38)
Heat transfer coefficient, W/K (37)m + (38)m					
(39)m 99.63 98.40 98.40 9	5.96 94.33 93.5	92.70 92.70	94.74 95.96	97.18 98.40	
			Average = $\sum (39)11$	2/12 = 95.99	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)				1 1	
(40)m 1.21 1.20 1.20 1	1.17   1.15   1.14	1.13 1.13	1.15   1.17	1.18   1.20	
			Average = $\sum (40)11$	2/12 = 1.17	(40)
4. Water heating energy requirement					
3 3/ 1				kWh/year	
Assumed occupancy, N			2.5		
If TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA	A - 13.9)²)] + 0.0013 x (TEA	- 13.9)		(12)	
If TFA ≤ 13.9, N = 1	( 13.5) )] · 0.0013 x (11)	13.37			
Annual average hot water usage in litres per day Vd,ave	erage = (25 x N) + 36		93.6	67 (43)	
Annual average hot water usage has been reduced by 5		ed to achieve a water us			
per person per day (all water use, hot and cold)					
	Apr May Jun	Jul Aug	Sep Oct	Nov Dec	
Hot water usage in litres per day for each month Vd,m  (44)m  103.04  99.29  95.54  9	= factor from Table 1c x (4 1.80   88.05   84.3	·	91.80 95.54	99.29 103.04	
(44)m 103.04 99.29 95.54 9	1.60   66.05   64.5	64.50 66.05	-		(44)
From content of het water and reducted as 111	- 4 100 v Vd · · · · · · · · · · · · · · · · ·	/2600   NATE /	∑(44)1	12 = 1124.04	(44)
Energy content of hot water used - calculated monthly (45)m 153.17 133.96 138.23 12	= 4.190 x Vd,m x nm x 1m 20.52   115.64   99.79		107.37 125.14	136.59 148.33	
(15),11   155,50   150,25   17	113.07   33.7	52.77 100.11	Σ(45)1		(45)
If instantaneous water heating at point of use (no hot v	vater storage) enter O in l	oxes (46) to (61)	2(43)1	12 - 14/7.32	(40)
For community heating include distribution loss whethe					
Distribution loss 0.15 x (45)m					

(46)m	22.97	20.09	20.74	18.08	17.35	14.97	13.87	15.92	16.11	18.77	20.49	22.25	(46)
Water storag	e loss:												
b) If manufac	turer's declared	d cylinder lo	ss factor is	not known	:								
Cylinder v	olume (litres) ir	ncluding any	solar stora	ige within s	ame cylind	er		1	135.00	(50)			
If commu	nity heating and	d no tank in	dwelling, ei	nter 110 lit	res in box (.	50)							
Otherwise	if no stored ho	t water (thi	s includes ir	nstantaneo	us combi bo	oilers) ente	r '0' in box	(50)					
Hot water	storage loss fa	ctor from Ta	able 2 (kWh	/litre/day)					0.01	(51)			
If commu	nity heating see	SAP 2009 s	ection 4.3										
Volume fa	ctor from Table	2a							0.96	(52)			
Temperat	ure factor from	Table 2b							0.54	(53)			
Energy los	t from water st	orage, kW	h/day (50)	x (51) x (5	2) x (53)				0.81	(54)			
Enter (49) or	(54) in (55)								0.81	(55)			
Water storag	e loss calculate	d for each n	nonth = (55	) x (41)m									
(56)m	25.09	22.66	25.09	24.28	25.09	24.28	25.09	25.09	24.28	25.09	24.28	25.09	(56)
If cylinder co	ntains dedicate	d solar stora	age, = (56)m	n x [(50) - (H	H11)] ÷ (50)	, else = (56	)m where (	H11) is fror	n Appendi	кH			_
(57)m	25.09	22.66	25.09	24.28	25.09	24.28	25.09	25.09	24.28	25.09	24.28	25.09	(57)
Primary circu	it loss (annual)	from Table	3					3	360.00	(58)			
Primary circu	it loss for each	month (58)	÷ 365 × (41	)m									
(modified by	factor from Tab	le H5 if the	re is solar w	ater heatir	ng and a cy	linder theri	mostat)						_
(59)m	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)
Combi loss fo	r each month f		a, 3b or 3c	(enter '0' if	not a com	bi boiler)							7
(61)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
	quired for wate									1		<u> </u>	1
(62)m	208.83	184.24	193.90	174.39	171.31	153.66	148.13	161.77	161.25	180.80	190.47	204.00	(62)
	put calculated i									1			1
(63)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	]
										∑(63)1	.12 =	0.00	(63)
	water heater fo	-						1 -		1			1
(64)m	208.83	184.24	193.90	174.39	171.31	153.66	148.13	161.77	161.25	180.80	190.47	204.00	]
										∑(64)1	.12 = 2	132.75	(64)
if (64)m < 0 tl													
_	om water heatii												1 ,>
(65)m	95.46	84.77	90.50	83.17	82.98	76.28	75.28	79.81	78.80	86.14	88.51	93.85	(65)
include	? (57)m in calcu	lation of (65	o)m only if c	tylinder is ir	i the dwelli	ng or hot w	vater is fror	n communi	ty heating				
5. Internal g	ains (see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gai	ins (Table 5), W	atts											
(66)m	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	(66)
Lighting gains	(calculated in	Appendix L,	equation L	9 or L9a), a	lso see Tab	le 5							

5. Internal gains	(see Table	5 and 5a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (T	able 5), Wa	atts											
(66)m	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	150.24	(66)
Lighting gains (cald	culated in A	ppendix L,	equation L	9 or L9a), a	lso see Tab	le 5							
(67)m	51.91	46.11	37.50	28.39	21.22	17.92	19.36	25.16	33.77	42.88	50.05	53.36	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	334.42	337.89	329.14	310.52	287.02	264.94	250.18	246.71	255.46	274.07	297.57	319.66	(68)
Cooking gains (cal	culated in A	Appendix L,	equation L	15 or L15a)	, also see T	able 5							
(69)m	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	52.53	(69)
Pumps and fans ga	ains (Table	5a)											
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evapor	Losses e.g. evaporation (negative values) (Table 5)												
(71)m	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	-100.16	(71)
Water heating gai	ns (Table 5)	)											

(72)m	128.31	126.14	121.64	115.51	111.54	105.94	101.18	107.28	109.44	115.78	122.94	126.15 (7)
Total internal gain			1		-	-	101.10	107.20	103.44	113.70	122.54	120.13
(73)m	627.25	622.74	600.88	567.03	532.39	501.40	483.33	491.76	511.28	545.35	583.17	611.77 (73
6. Solar gains												
Solar gains are co	alculated us	sina solar flu	x from Tab	le 6a and a	ssociated	eauations to	convert to	o the applica	able orient	ation.		
Rows (74) to (82)			-									
Details for month			-		_	, , , ,			,,,,			
•		Access facto		Area m²		olar flux W/	m² g	Specific da	ta FI	F Specific da	ta	Gains (W)
		Table 6d						or Table 6k		or Table 60		
Southwest		0.77	] x	3.00	] x	37.39	x 0.9 x	0.63	x	0.70	=	34.28 (79
Northeast		0.77	x	6.24	x	11.51	x 0.9 x	0.63	x	0.70	=	21.95 (7
Southeast		0.77	] x	4.16	] x	37.39	x 0.9 x	0.63	] x	0.70	=	47.53 (7
Solar gains in wat	ts, calculat	ed for each	month ∑(7	4)m(82)m	1							
(83)m	103.76	184.38	262.71	355.75	419.19	437.68	424.12	374.33	301.00	214.79	125.79	87.76 (83
Total gains - inter	nal and sol	ar (73)m + (	83)m									
(84)m	731.01	807.13	863.59	922.78	951.58	939.08	907.45	866.09	812.28	760.13	708.96	699.54 (84
7. Mean interna	l temperat	ure (heating	g season)									
Temperature dur	ing heating	periods in t	he living ar	rea from Ta	ble 9, Th1	(°C)						21.00 (8
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor	for gains fo		, η1,m (see	Table 9a)					1			
(86)m	0.99	0.98	0.96	0.92	0.80	0.61	0.42	0.44	0.72	0.92	0.98	0.99 (80
Mean internal ter			·	1						1		
(87)m	20.16	20.28	20.46	20.66	20.85	20.93	20.94	20.94	20.90	20.71	20.38	20.19 (8
Temperature dur		<u> </u>		1	1					1		
(88)m	19.91	19.93	19.93	19.95	19.96	19.97	19.98	19.98	19.96	19.95	19.94	19.93 (88
Utilisation factor	for gains fo		elling η2,m	(see Table					1			
(89)m	0.99	0.97	0.95	0.89	0.74	0.52	0.31	0.33	0.63	0.89	0.97	0.99 (89
Mean internal ter			1						1	1		
(90)m	18.82	19.00	19.26	19.55	19.79	19.88	19.90	19.90	19.85	19.61	19.15	18.86 (90
Living area fraction	on							fLA	32.95	÷ (4) =	:	0.40 (9:
Mean internal ter				fLA x T1 +(	1 - fLA) x T	2						
(92)m	19.36	19.51	19.74	19.99	20.21	20.30	20.32	20.32	20.27	20.05	19.64	19.39 (93
Apply adjustment												
(93)m	19.21	19.36	19.59	19.84	20.06	20.15	20.17	20.17	20.12	19.90	19.49	19.24 (93
8. Space heating	requirem	ent										
or opuse meaning	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Set Ti to the mea					_			_	-			
Utilisation factor			obtained	11 51CP 11 0	T Tubic 36	, so that tim	- (55)iii a	na recalcala	ite the utili	sation racto	i ioi gain.	danig rubic su
(94)m	0.98	0.97	0.94	0.89	0.75	0.54	0.33	0.35	0.64	0.88	0.97	0.98 (94
Useful gains, nm(									1			
(95)m	717.96	783.60	814.94	818.81	711.56	507.22	302.37	302.16	523.42	672.37	687.11	687.78 (9
Monthly average												,
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90 (90
Heat loss rate for												, , , ,
(97)m	1465.29		1258.50	1069.21	789.04	519.02	303.11	303.09	551.51	873.32	1213.89	1411.39 (9
Space heating red												
(98)m	556.01	422.99	330.01	180.29	57.65	0.00	0.00	0.00	0.00	149.51	379.29	538.37
		•		•						8)15, 10		2614.10 (98
Space heating red	guirement i	in kWh/m²/\	/ear				1		, 20	(98)		31.79 (99
,	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	, / )	,							(50)	` /	

Constructions	
Space heating:	
Fraction of space heating from secondary/supplementary system (Table 11) 0.00 (201)	
Fraction of space heating from main system(s) 1 - (201)  1.00 (202)	
Fraction of main heating from main system 2 0.00 (203)	
Fraction of total space heat from main system 1 (202) x [1 - (203)] 1.00 (204)	
Fraction of total space heat from main system 2 (202) x (203) 0.00 (205)	
Efficiency of main space heating system 1 (%) 90.60 (206)	
(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Space heating requirement, kWh/month (as calculated above)	
(98)m 556.01 422.99 330.01 180.29 57.65 0.00 0.00 0.00 149.51 379.29 538.3	/
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)	
(211)m 613.69 466.87 364.24 199.00 63.63 0.00 0.00 0.00 165.02 418.64 594.2	=
Total per year (kWh/year) = $\sum (211)15$ , $1012 = 2885.32$	(211)
Water heating:	
Output from water heater, kWh/month (calculated above)	
(64)m 208.83   184.24   193.90   174.39   171.31   153.66   148.13   161.77   161.25   180.80   190.47   204.0	0
$\Sigma$ (64)112 = 2132.75	(64)
Efficiency of water heater per month	
(217)m 87.40 87.06 86.32 85.00 82.35 79.90 79.90 79.90 79.90 84.41 86.72 87.38	3
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m	
(219)m 238.93 211.62 224.63 205.15 208.02 192.31 185.40 202.47 201.81 214.19 219.64 233.4	5
Total per year (kWh/year) = $\sum (219)112 = 2537.63$	(219)
Annual Totals Summary: kWh/year kWh/year	
Space heating fuel used, main system 1 2885.32	(211)
Space heating fuel used, main system 1  Water heating fuel used  2885.32  2537.63	
	(211)
Water heating fuel used 2537.63	(211)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):	(211)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump  2537.63  155.52  0.00  130.00	(211) (219) (230a)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump  2537.63  155.52  0.00  130.00  0.00	(211) (219) (230a) (230b)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan  2537.63  2537.63	(211) (219) (230a) (230b) (230c) (230d) (230e)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler  2537.63  2537.63  2537.63	(211) (219) (230a) (230b) (230c) (230d) (230e) (230f)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  2537.63  2537.63  2537.63  155.52  0.00  130.00  0.00  0.00  0.00  0.00  0.00	(230a) (230a) (230b) (230c) (230d) (230e) (230f) (230g)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler  2537.63  2537.63  155.52  0.00  130.00  45.00  0.00	(211) (219) (230a) (230b) (230c) (230d) (230e) (230f)
Water heating fuel used       2537.63         Electricity for pumps, fans and electric keep-hot (Table 4f):	(211) (230a) (230a) (230b) (230c) (230d) (230e) (230f) (230g) (231)
Water heating fuel used       2537.63         Electricity for pumps, fans and electric keep-hot (Table 4f):       155.52         mechanical ventilation fans - balanced, extract or positive input from outside       155.52         warm air heating system fans       0.00         central heating pump       130.00         oil boiler pump       0.00         boiler flue fan       45.00         maintaining electric keep-hot facility for gas combi boiler       0.00         pump for solar water heating       0.00         Total electricity for the above       ∑(230a)(230g)       330.52         Electricity for lighting (calculated in Appendix L):       366.73	(230a) (230a) (230b) (230c) (230d) (230e) (230f) (230g)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q):	(230a) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232)
Water heating fuel used       2537.63         Electricity for pumps, fans and electric keep-hot (Table 4f):       155.52         mechanical ventilation fans - balanced, extract or positive input from outside       155.52         warm air heating system fans       0.00         central heating pump       130.00         oil boiler pump       0.00         boiler flue fan       45.00         maintaining electric keep-hot facility for gas combi boiler       0.00         pump for solar water heating       0.00         Total electricity for the above       ∑(230a)(230g)       330.52         Electricity for lighting (calculated in Appendix L):       366.73	(211) (230a) (230a) (230b) (230c) (230d) (230e) (230f) (230g) (231)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q):	(230a) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Electricity generated by PVs (Appendix M) (negative quantity)  Fuel kWh/year  Fuel price Fuel kWh/year Fuel price Fuel cost £/ye	(211) (219) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232)
Water heating fuel used  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans central heating pump oil boiler pump boiler flue fan maintaining electric keep-hot facility for gas combi boiler pump for solar water heating  Total electricity for the above  Electricity for lighting (calculated in Appendix L):  Energy saving/generation technologies (Appendices M, N and Q):  Electricity generated by PVs (Appendix M) (negative quantity)  Fuel kWh/year  Fuel price (Table 12)  Fuel cost £/y	(211) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232) (233)
Water heating fuel used 2537.63  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans 0.00 130.00 130.00 100	(211) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232) (233)
Water heating fuel used 2537.63  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans 0.00 central heating pump 130.00 oil boiler pump 0.00 boiler flue fan 45.00 maintaining electric keep-hot facility for gas combi boiler pump 0.00 compump cosolar water heating 0.00 compump for solar water hea	(211) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232) (233) (233) ear (240) (247)
Water heating fuel used       2537.63         Electricity for pumps, fans and electric keep-hot (Table 4f):         mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans       155.52         warm air heating system fans       0.00         central heating pump       130.00         oil boiler pump       0.00         boiler flue fan       45.00         maintaining electric keep-hot facility for gas combi boiler pump for solar water heating       0.00         Total electricity for the above       ∑(230a)(230g)       330.52         Electricity for lighting (calculated in Appendix L):       366.73         Energy saving/generation technologies (Appendices M, N and Q):       366.73         Electricity generated by PVs (Appendix M) (negative quantity)       -657.28         10a. Fuel costs - Individual heating systems including micro-CHP       Fuel kWh/year       Fuel price (Table 12)       Fuel cost £/y (Table 12)         Space heating - main system 1       2885.32       x       3.10       x 0.01 =       89.45         Water heating cost (other fuel)       2537.63       x       3.10       x 0.01 =       78.67         Pumps, fans and electric keep-hot       330.52       x       11.46       x 0.01 =       37.86	(211) (219) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232) (233) ear (240) (247) (249)
Water heating fuel used 2537.63  Electricity for pumps, fans and electric keep-hot (Table 4f):  mechanical ventilation fans - balanced, extract or positive input from outside warm air heating system fans 0.00 central heating pump 130.00 oil boiler pump 0.00 boiler flue fan 45.00 maintaining electric keep-hot facility for gas combi boiler pump 0.00 compump for solar water heating 0.00 compump for solar water h	(211) (230a) (230b) (230c) (230d) (230e) (230g) (231) (232) (233) (233) ear (240) (247)

PV savings (negative quantity)	-657.28	х	11.46 x 0.0	1 = -75.32	(252)
Total energy cost			(240)(242) + (245)	(254) 278.69	(255)
11a. SAP rating - Individual heating systems including mic	cro-CHP				
Energy cost deflator (Table 12)				0.47	(256)
Energy cost factor (ECF)			[(255) x (256)] ÷ [(4) + 4	15.0] = 1.03	(257)
SAP value				85.64	
SAP rating				86	(258)
SAP band				В	
12a. Carbon dioxide emissions - Individual heating system	ns including micro-CHP				
	Energy kWh/year		Emissions Factor	Emissions (kgCO2/yea	
Space heating - main system 1	2885.32	Х	0.198 =	571.29	(261)
Water heating	2537.63	х	0.198 =	502.45	(264)
Space and water heating			(261) + (262) + (263) + (	264) = 1073.74	(265)
Pumps, fans and electric keep-hot	330.52	x	0.517 =	170.88	(267)
Lighting	366.73	x	0.517 =	189.60	(268)
Energy saving/generation technologies:					
PV emission savings (negative quantity)	-657.28	х	0.529 =	-347.70	(269)
Total carbon dioxide emissions			∑(261)(	271) = 1086.52	(272)
Dwelling carbon dioxide emissions rate			(272)	÷ (4) = 13.21	(273)
El value				88.56	
El rating (see section 14)				89	(274)
EI band				В	
13a. Primary energy - Individual heating systems includin	g micro-CHP				
	Energy kWh/year		Primary Energy Factor	Primary Ener	gy
Space heating - main system 1	2885.32	x	1.02 =	2943.03	(261*
Water heating	2537.63	x	1.02 =	2588.38	(264*
Space and water heating			(261*) + (262*) + (263*) + (2	64*) = 5531.41	(265*
Pumps, fans and electric keep-hot	330.52	х	2.92 =	965.11	(267
Lighting	366.73	х	2.92 =	1070.84	(268
Energy saving/generation technologies:					
PV primary energy savings (negative quantity)	-657.28	х	2.92 =	-1919.26	(269*
Total primary energy kWh/year			Σ(261*)(2	71*) = 5648.10	(272*

68.68

(272\*) ÷ (4) = [

Primary energy kWh/m2/year